



SEA LEVEL RISE ADAPTATION STRATEGY FOR SAN DIEGO BAY

Existing Conditions Report

Final Report

May 1, 2011



Prepared by ICLEI-Local Governments for Sustainability for the project's Public Agency Steering Committee

TABLE OF CONTENTS

1. Introduction	4
2. The San Diego Bay Landscape.....	7
2.1 Policy Landscape	7
2.1.1 Jurisdictional Authority and Boundaries	7
2.1.2 Major Plans and Policies	11
2.2 Physical Landscape	16
2.2.1 The Built Environment	16
2.2.2 The Natural Environment	31
2.3 Social Landscape.....	36
2.3.1 Vulnerable Populations.....	36
2.3.2 Economic Hubs.....	36
2.3.3 Public Access.....	37
2.3.4 Arts and Culture.....	37
2.3.5 Historic Resources.....	38
3. Climate Change and Sea Level Rise Scenarios	39
3.1 Global Climate Change.....	39
3.2 Regional Climate Change	40
3.3 Climate Change Impacts on the San Diego Bay Area	42
3.4 Flood Mapping of the San Diego Bay Area	42
4. Next Steps.....	46
5. Endnotes	47

LIST OF FIGURES

1.1	Potential Sea Level Rise Inundation in 2100	6
2.1	Planning Area	8
2.2	Jurisdictional Boundaries	9
2.3.1	Existing Land Use - North	19
2.3.2	Existing Land Use - South	20
2.4	Water, Wastewater, and Energy Facilities	24
2.5	Emergency Response Facilities	26
2.6	Critical Contaminated Sites	28
2.7	Regional Transportation Facilities	30
2.8	Critical Habitat	32
2.9	Topography and Floodplains	35
3.1	IPCC Emissions Scenarios	39
3.2	Projected Temperature Changes in San Diego	40
3.3	Historic Tide Gage Record	41
3.4	Half-Meter Sea Level Rise Flooding Scenarios	44
3.5	1.5-Meter Sea Level Rise Flooding Scenarios	45

1. INTRODUCTION

The Time to Plan for Sea Level Rise

The San Diego region is a hotbed of economic activity, diversity, and culture in Southern California. The region has long been known for its remarkable landscape, economic prowess and prestigious academic institutions, and many have acclaimed it as one of the nation's most livable communities. While the region's growth and status as an economic center is projected to continue for the foreseeable future, real threats to this status are posed by the impacts of climate change to the social, economic and environmental well-being of the San Diego region. Among these expected climate change impacts, perhaps none poses a greater risk than sea level rise. Elevation of the mean high tide line could change by as much as 1.5 meters by 2100, resulting in widespread inundation of shoreline areas, as shown in Figure 1.1.

San Diego is a region defined by its relationship with the coast and heavily invested in its coastal communities. With so much at stake, many jurisdictions are beginning to evaluate and manage risks from sea level rise and other climate impacts through a planning process known as "climate adaptation planning." They are recognizing that it is critical to begin considering policy responses long before the worst impacts associated with sea level rise are projected to occur, because developing and implementing solutions will require unprecedented collaboration with long lead-times, and because infrastructure is being built now that will be vulnerable to impacts in the future.

It is in that spirit that a Public Agency Steering Committee comprised of staff from the five bay-front cities, the San Diego Unified Port District, and the San Diego County Regional Airport Authority have come together to develop a *Sea Level Rise Adaptation Strategy for San Diego Bay* (Adaptation Strategy).

Planning Process and Anticipated Outcomes

The Adaptation Strategy is intended to provide participating Steering Committee jurisdictions with policy recommendations to that will aide in begin making their bay-front communities more resilient to sea level rise and the associated impacts, such as coastal flooding, erosion, and ecosystem shifts. The planning effort complements several related initiatives in the region. In the City of Chula Vista, the City Council recently accepted climate adaptation recommendations from its Climate Change Working Group that will be further developed into implementation plans in the coming six months. Both the City of San Diego and the Port of San Diego are developing adaptation policies in climate action plans, targeted for adoption in January 2012, and the City of National City is also currently developing a climate action plan. Also significant is research performed by The San Diego Foundation, University of California San Diego, Scripps Institute of Oceanography, and San Diego State University around climate change projections and sea level rise scenarios for the greater San Diego Bay area.

The multi-jurisdictional Adaptation Strategy will both draw upon and inform these local efforts. It will be developed through a series of milestones over the next year and is targeted for completion in September 2011. The major milestones and expected completion dates are:

- An **Existing Conditions Report** that documents the San Diego Bay landscape. (November 2010)
- A **Vulnerability Assessment** that evaluates the exposure of various systems in the area to sea level rise impacts and whether they can accommodate those impacts. (March 2011)
- **Policy Recommendations** that participating jurisdictions can consider adopting through existing planning processes or through their own stand-alone process. (July 2011)
- **Implementation Strategies** for putting the recommendations into practice. (July 2011)
- An **Adaptation Strategy** that assembles the previous work in a narrative planning document. (September 2011)

A Stakeholder Working Group has been assembled to contribute to the planning process. The group consists of approximately 25 organizations and agencies that have a direct interest in the future of the Bay shoreline. The group will meet four times during the course of the project to learn about sea level rise adaptation and to contribute their perspective on how to build a more resilient San Diego Bay. These meetings will take the form of applied training workshops where participants will first hear from topic experts, then provide input on planning documents under development.

The Role of the Existing Conditions Report

This Existing Conditions Report assembles information about the San Diego Bay coastal area as a means to establish the “state of the knowledge” upon which the Adaptation Strategy planning process should be based. Information within this document has been compiled from a wide variety of sources and is organized into three chapters: an introduction, and two substantive chapters addressing the themes of ‘The San Diego Bay Landscape’, and ‘Climate Change and Sea Level Rise Scenarios’. Chapter 2, The San Diego Bay Landscape, describes the policy, physical, and social landscape of the Bay. Chapter 3, Climate Change and Sea Level Rise Scenarios, reviews existing literature on global emissions trends and climate change projections, climate change projections at the regional level, and potential impacts to the San Diego region.

Next Steps

This Existing Conditions Report will be revised based on input received at the Stakeholders Working Group workshop on November 1, 2010. Stakeholders can also provide written comments up to November 5, at which time all comments will be addressed in a Final version of the document for Public Agency Steering Committee review. Changes made based on stakeholder comments will be presented at the Working Group’s subsequent workshop, currently targeted for late-February. Between November and February, ICLEI will use the Report to inform the development of the next deliverable: the Vulnerability Assessment.

Figure 1.1 Potential Sea Level Rise Inundation in 2100



2. THE SAN DIEGO BAY LANDSCAPE

The San Diego Bay Adaptation Strategy will be focused on lands around San Diego Bay that could be affected by sea level rise in the 2050 and 2100 timeframes. The planning area for this effort was established to include all areas shown on flood maps depicting a high-end sea level rise scenario for 2100 (1.5 meters).¹ As a result, the area extends beyond the historic mean high tide line and slightly beyond the Coastal Commission's coastal zone boundary. This chapter documents the landscape of this complex coastal area through several different lenses: the policy landscape, the physical landscape (including both the built and natural environments), and the social landscape.

In addition to establishing an overall planning area, a number of subareas were delineated to assist in organizing and presenting information throughout the project. The subarea boundaries are based on city boundaries, community plan areas, and Port Master Plan subareas, as illustrated in Figure 2.1. The subareas are (from northwest, clockwise around the Bay):

- San Diego – Peninsula
- San Diego – Midway
- San Diego – Airport / Harbor Island
- San Diego – Centre City
- San Diego – Barrio Logan
- National City
- Chula Vista
- San Diego – Nestor
- Imperial Beach
- Coronado – Silver Strand
- Coronado – Island

2.1 Policy Landscape

The coastal communities of California are well-known for their human and species diversity, but they are also notable for the diversity of government regulations, policies, and plans that define the nature of local development. Adaptation planning for the built and natural environment of the Bay cannot be effective without an understanding of the policy environment, which is described in the following section.

2.1.1 *Jurisdictional Authority and Boundaries*

Multiple local, regional, state and federal agencies are responsible for managing the San Diego Bay coastal area. Two state commissions provide regulatory oversight of coastal land use, and various local jurisdictions have direct regulatory and management responsibilities. This section provides a brief overview of these responsibilities. Figure 2.2 illustrates the boundaries of these jurisdictions.

¹ Gersberg, R. (2010) *1.5 meter sea level rise scenarios*.

Figure 2.1 Planning Areas

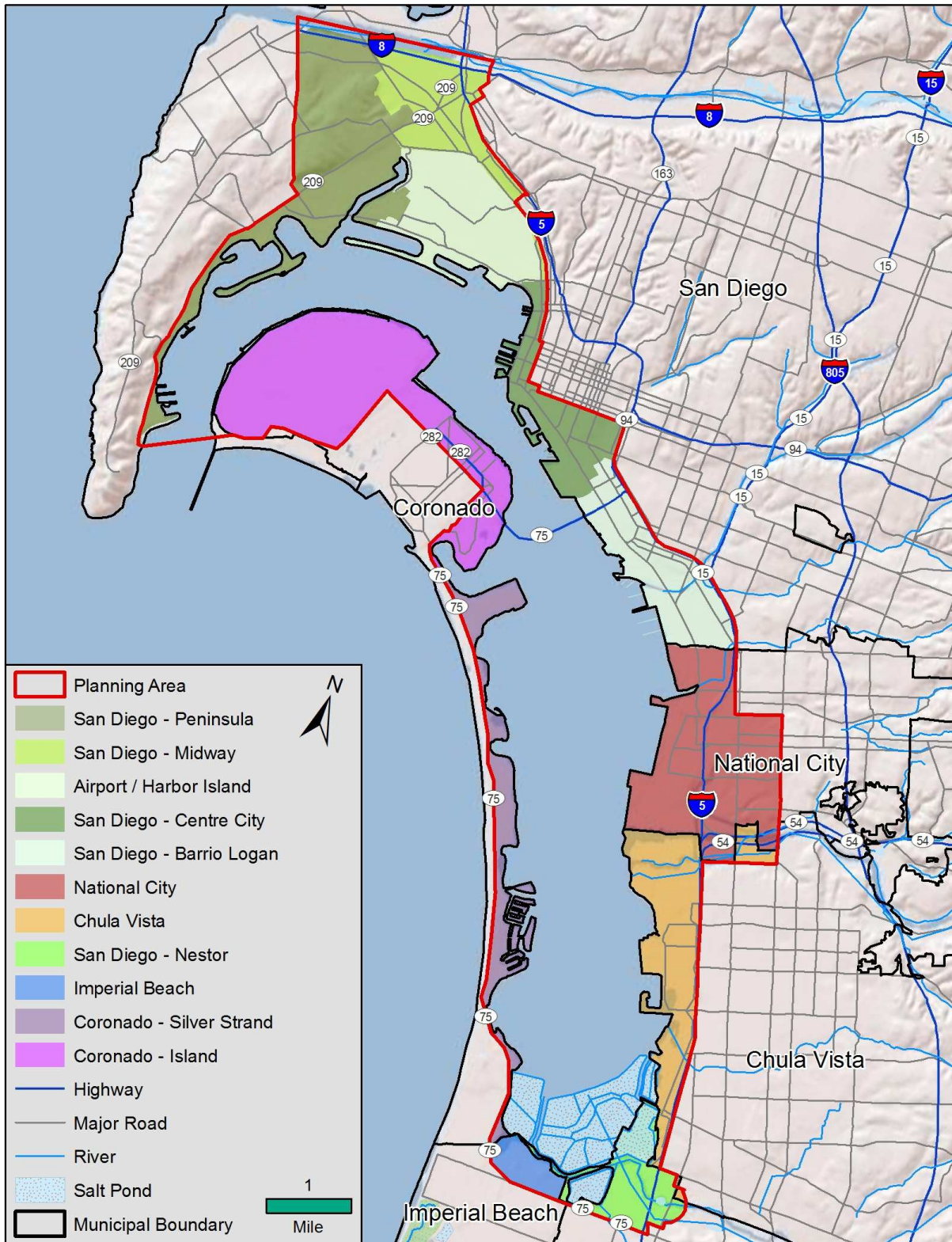
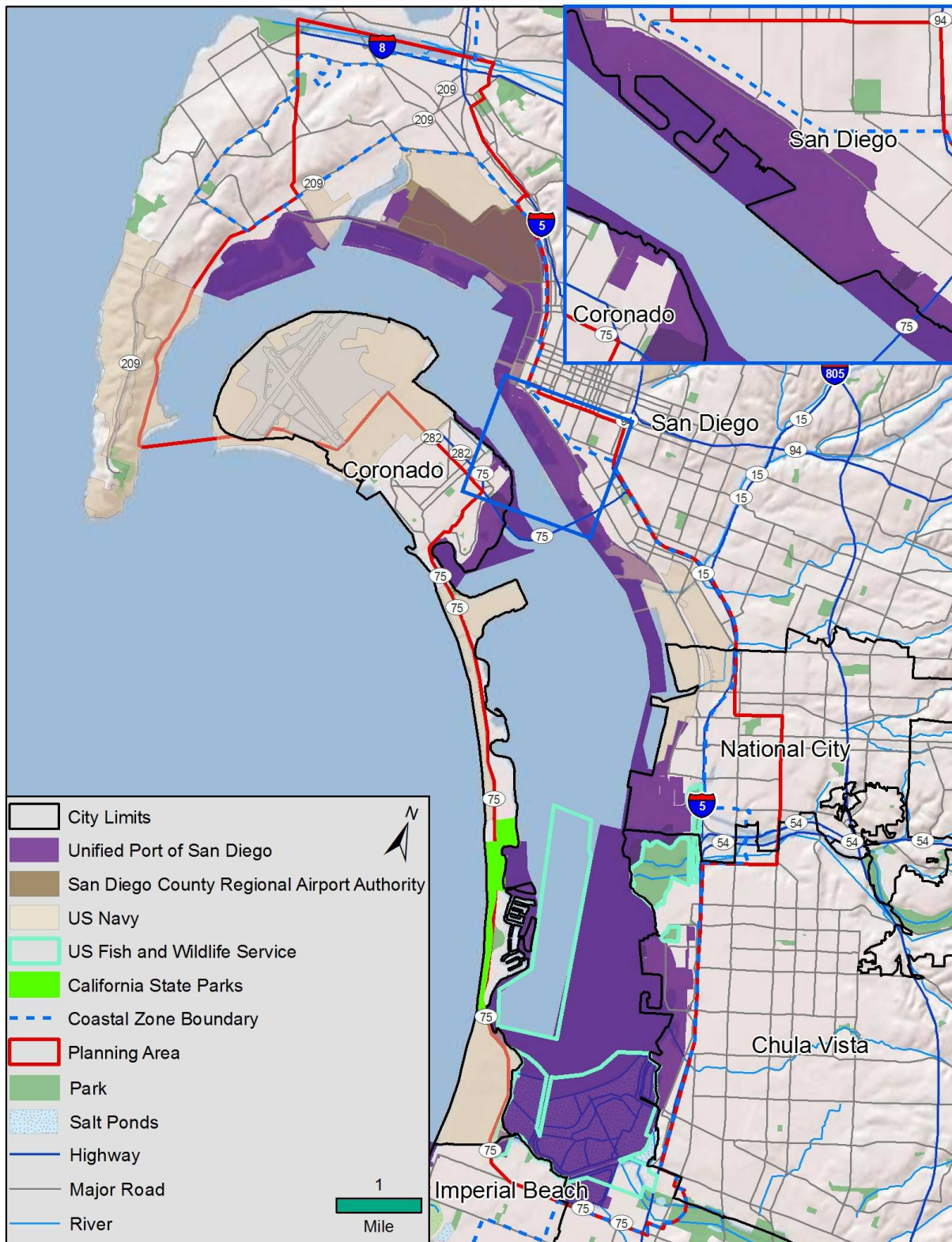


Figure 2.2 Jurisdictional Boundaries



State of California Commissions. Under the *California Coastal Act of 1976* (Coastal Act), the *California Coastal Commission* regulates development along the coast to ensure compliance with Coastal Act standards for public access, recreation, views, environmental protection, and hazards. The Commission's jurisdiction is applicable inside the Coastal Zone boundary.

Under the public trust doctrine, states are granted title to all submerged lands and tidelands, to be managed for common public use. The California State Legislature entrusted the *State Lands Commission* with responsibility for managing these lands on behalf of the public. The Commission then grants trusteeship to various regional and state agencies to carry out its goals at the local level.

San Diego Unified Port District. The San Diego Unified Port District is a public benefit corporation established in 1962 by an act of the California State legislature and ratified by the voters of the Port's five member cities—Chula Vista, Coronado, Imperial Beach, National City and San Diego. This legislation established the Port to further the development of commerce, navigation, fisheries, and recreation on behalf of the state of California, which manages these lands. The lands are conveyed to the Port as a trustee of the state by the State Lands Commission, and include approximately 2,500 acres of land and 3,400 acres of water. The Port is governed by a Board of Commissioners appointed by the five member cities.

Cities. Five cities border San Diego Bay: San Diego, National City, Chula Vista, Imperial Beach, and Coronado. These cities regulate land use in the planning area, except in Port-managed areas where the Port retains land use authority. For Port tenant projects, the Port defers to the member cities for review of building permits under applicable building codes, however.

San Diego County Regional Airport Authority. The San Diego County Regional Airport Authority has planning and operational jurisdiction for the 661 acres that comprise San Diego International Airport located on state tidelands. It is governed by an appointed board representing all areas of San Diego County.

U.S. Navy. San Diego Bay is home to a large naval fleet and multiple facilities related to research, training, cargo handling, storage and other uses by Naval Base San Diego, Naval Base Coronado, and Naval Base Point Loma. The Navy owns and has sole regulatory authority over approximately 1,900 acres in the planning area. The Marine Corps Recruit Depot is also in the planning area, north of San Diego International Airport.

U.S. Fish and Wildlife Service. The Fish and Wildlife Service manages San Diego Bay National Wildlife Refuge, which includes Sweetwater Marsh, the Salt Ponds, and part of the Otay River floodplain. Most of these lands are managed under a lease from the State Lands Commission and are under protection for threatened and endangered species.

California Department of Parks and Recreation. California Department of Parks and Recreation manages Silver Strand State Beach for recreation, under a grant from the State Lands Commission.

2.1.2 Major Plans and Policies

The agencies described above exercise their authority over coastal lands by developing and implementing a variety of plans and policies. This section describes the major plans and policy tools in effect in the planning area, in order to meet three objectives: to document what policies are applicable in the planning area; to evaluate how they are related to sea level rise; and to evaluate how they do or do not currently account for sea level rise.

General Plans and Community Plans

California state law requires every local jurisdiction to prepare a General Plan to establish comprehensive, long-range policy for development in the community. The policies of the General Plan are intended to underlie most land use decisions. Pursuant to state law, subdivisions, capital improvements, development agreements, and many other land use actions must be consistent with the adopted general plan. In counties and general law cities (all Bay cities are general law cities except San Diego), zoning and specific plans are also required to conform with the General Plan. The City of San Diego is a Charter City, but as a matter of practice applies zoning that is consistent with the General Plan and community plan.

State guidelines require the inclusion of seven “elements” or topics in general plans. Of these, the following elements are particularly relevant to sea level rise planning:

- **Land Use.** The land use element designates the type, intensity, and general distribution of uses of land.
- **Circulation.** The circulation element is correlated with the land use element and identifies the general location and extent of existing and proposed major transportation routes.
- **Conservation.** The conservation element addresses the conservation, development, and use of natural resources.
- **Open Space.** The open-space element details plans and measures for the long-range preservation and conservation of open-space lands, including open space for the preservation of natural resources, outdoor recreation, and public health and safety.
- **Safety.** The safety element establishes policies and programs to protect the community from hazards, including flooding.

In addition to these required elements, optional elements can be developed for such areas as capital improvements, economic development, and public health that could be affected by sea level rise considerations. The City of San Diego General Plan calls for collaboration with “climate science experts on local climate change impacts, mitigation, and adaptation, including sea level changes, to inform public policy decisions.” To date, no other general plans in the San Diego region have referenced sea level rise as a planning consideration.

Community plans focus on a particular region or community within the general plan area. They refine the policies of the general plan, are adopted as general plan amendments, and are implemented through ordinances such as zoning. The Adaptation Strategy planning area includes several City of San Diego community planning areas: Peninsula, Midway-Pacific Highway, Centre City, Barrio Logan, and Otay Mesa-Nestor. In a recent draft of the Barrio Logan Community Plan Update, the City of San Diego did refer to inundation maps for a

projected half-meter sea level rise by 2050, which showed no impact on the Barrio Logan community.

Local Coastal Programs

Under the *California Coastal Act of 1976* (Coastal Act), the California Coastal Commission has established a statewide Coastal Zone where it regulates development to ensure compliance with Coastal Act standards for public access, recreation, views, environmental protection, and hazards. Local Coastal Programs (LCPs) are land use plans prepared by local jurisdictions for areas inside this Coastal Zone. LCPs must be approved by the Coastal Commission for conformity with the Coastal Act, and upon approval, the Commission's coastal permitting authority over most new development is transferred to the local government, which applies the requirements of the LCP in reviewing proposed new developments.

In the City of San Diego, the community plans described in the previous section serve as LCPs. In Imperial Beach and Coronado, the General Plan Land Use Element (without the Housing Element) serves as the Local Coastal Program. National City has adopted an LCP that references the applicable provisions of the general plan and zoning code. Chula Vista's LCP is a separate document from its General Plan.

Many potential sea level rise adaptation strategies will relate to land use planning and development regulations. These strategies will be reflected in Local Coastal Programs and must be consistent with the Coastal Act as evaluated and approved by the Coastal Commission. The Coastal Commission is an important stakeholder in developing the San Diego region's approach to coastal resiliency in the face of climate change impacts.

San Diego Unified Port District Master Plan

The Port of San Diego Master Plan provides planning policies for the physical development of the tide and submerged lands granted in trust to the San Diego Unified Port District. As described in the Plan, its purposes include use by the Board of Port Commissioners as a reference indicating needed policy changes and as a guide for policy decisions; by the Port staff as a basis for capital improvements programming and for rendering services; by other governmental agencies as necessary information leading to coordinated efforts; and to individuals as an accurate source of information, as an indication of new opportunities for private action and investment, and as a basis for protecting existing development. The California Coastal Commission certified the initial Port Master Plan on January 21, 1981, and by statute, the Port Master Plan is to be incorporated into the Local Coastal Programs of the county and the five Port member cities. These cities include San Diego, National City, Chula Vista, Coronado, and Imperial Beach. Subsequent Amendments to the Port Master Plan must first be adopted by the Board of Port Commissioners, then certified by the Coastal Commission prior to inclusion in the Port Master Plan.

As the primary planning document for Port tidelands (the majority of land in the Adaptation Strategy planning area is within the Port's permitting jurisdiction), the Port Master Plan is an important reference document with respect to new and existing development. While the existing Port Master Plan does not currently address future sea level rise in its policy

formulation, the Port has begun development of a Climate Mitigation and Adaptation Plan that is tentatively scheduled for completion in the first quarter of 2012.

San Diego International Airport Master Plan

The San Diego County Regional Airport Authority has adopted the San Diego International Airport Master Plan that describes the existing and planned airport uses (airfield, terminal, ground transportation and airport support) within the boundaries of the Airport.

Multiple Species Conservation Program and Subarea Plans

Several local jurisdictions on San Diego Bay meet state and federal requirements for habitat conservation planning in the Adaptation Strategy planning area through the regional Multiple Species Conservation Program (MSCP). The MSCP establishes a framework for conservation planning for multiple species' habitat needs in a 900 square-mile area in southwestern San Diego County. It allows local jurisdictions to maintain land use control by establishing a regional preserve system that can meet future development project mitigation needs.

Local jurisdictions prepare MSCP Subarea Plans to implement the MSCP in their portion of the regional preserve. The San Diego and Chula Vista Subarea Plans are relevant in the Bay coastal environment. Both plans delineate core biological resource areas and corridors targeted for conservation, where only limited development may occur. In the Adaptation Strategy planning area, the San Diego MSCP preserve area includes southern portions of the Otay River corridor and floodplain to the river mouth and salt ponds. The Chula Vista Subarea Plan conservation area includes Sweetwater Marsh, as well as some northern portions of the Otay River valley that are upstream from the Adaptation Strategy planning area but that could be affected by sea level rise at the river mouth. These areas are described in more detail in the Natural Environment section of this report.

Sea level rise is not explicitly cited in the MSCP or Subarea Plans as a consideration in defining preserve boundaries or establishing habitat conservation policies. However, changes in coastal habitat due to sea level rise will likely change how cities and their partner agencies protect threatened and endangered species in the area.

California Environmental Quality Act (CEQA)

CEQA is a State statute requiring public agencies to evaluate the environmental impacts of discretionary development plans and projects in their jurisdictions. The environmental review must evaluate whether the project's impacts are "significant," as measured relative to pre-defined "thresholds of significance." When some impacts are found to be significant, the environmental document must identify mitigation measures to reduce the impacts to less-than-significant levels, and if all impacts cannot be mitigated, a full Environmental Impact Report (EIR) must be developed to provide an extensive environmental analysis and a statement of overriding considerations must be made based upon substantial evidence in the record (CEQA Guidelines Section 15093).

Guidelines for developing CEQA documents are produced by the California Office of Planning and Research (OPR). These guidelines were updated recently under Senate Bill 97, which required OPR to develop and include guidance for evaluating climate change impacts. The only revision pertinent to the relationship between development and sea level rise is as follows:

“The EIR shall also analyze any significant environmental effects the project might cause by bringing development and people into the area affected.... *the EIR should evaluate any potentially significant impacts of locating development in other areas susceptible to hazardous conditions (e.g., floodplains, coastlines, wildfire risk areas) as identified in authoritative hazard maps, risk assessments or in land use plans addressing such hazards areas.*” (Section 15126.2a)

As can be seen from above, state guidance for evaluating sea level rise-associated impacts in CEQA documents is limited and somewhat ambiguous. The above statement leaves unclear what would constitute an “authoritative” risk assessment or hazard map. Reputable academic institutions and public agencies have published analyses of the risk of sea level rise on California’s coast and related inundation maps, but these are not as authoritative as FEMA Flood Insurance Rate Maps, for example, which are known to be outdated.

Currently, there is no definitive guidance on addressing sea level rise in CEQA that would inform the development of adaptation strategies, but it is quite possible that the State will require review of impacts and potential adaptation actions associated with locating development and new populations in areas susceptible to climate change-related flooding in the lifespan of the plan or project.

San Diego County Multi-jurisdictional Hazard Mitigation Plan

The Multi-jurisdictional Hazard Mitigation Plan is prepared by San Diego County in cooperation with all local jurisdictions in the County. While voluntary, adoption of a plan is required to obtain critical emergency preparedness and post-disaster recovery funds from FEMA under the federal Disaster Mitigation Act of 2000. The San Diego County Plan was updated in 2010 and is currently being considered for adoption by the County’s local jurisdictions.

The Final Draft of the plan update evaluates both coastal erosion and coastal flooding in detail, including assessment of local vulnerabilities, exposure of property and estimates of potential economic loss, and hazard risk. However, the risk analysis upon which policies are based is grounded in historical hazard trends, not in projected changes in risk. For example, the plan’s flooding section relies on FEMA estimates of risk, based on the historical likelihood of flood events. Adequately accounting for sea level rise will necessitate a new approach to risk analysis as the likelihood of flooding and other impacts increase and cannot be accounted for by statistical analysis of past events.

The current iteration of the plan includes a “placeholder” for addressing climate change impacts, similar to treatment in the State Hazard Mitigation Plan. It identifies climate change impacts as an important issue and states that further analysis will be performed in the next update, likely to occur in 2015. The San Diego Bay Adaptation Strategy can draw upon several pieces of key information and planning approaches from the Multi-jurisdictional Hazard

Mitigation Plan, and can offer recommendations on how local jurisdictions could incorporate sea level rise-related flood hazards in the 2015 update.

Floodplain Management Programs and Regulations

To participate in and qualify for the National Flood Insurance Program (NFIP), cities must adopt a set of baseline floodplain management ordinances that meet Federal requirements. Adopting and enforcing these ordinances enables local property owners to obtain flood insurance, through the NFIP, which is administered and funded through the Federal Emergency Management Agency (FEMA). Local governments, however, in an effort to provide public health benefits, safety and general welfare to their citizens, and to minimize public and private losses due to flooding and flood conditions in specific areas, can go above beyond these minimum requirements. There are many combinations of regulations that a City could use to protect its citizens from flooding. Three of the major mechanisms are height regulations, buffer regulations and blanket development limitations.

All five Bay cities have adopted floodplain management ordinances that help avoid and protect against flood-related property damage and qualify them as participants in the NFIP. Several have gone above the minimum standards through freeboard regulations. The City of San Diego requires that new or substantially improved residential structures in designated flood zones be built 2 feet above FEMA standards. Similarly, National City, Chula Vista and Coronado have 1 foot freeboard ordinance. In addition to the freeboard ordinance and basic floodplain bylaws, all of the Bay cities have extensive floodplain management programs.

To enhance municipal floodplain management performances, FEMA operates an incentive program called the Community Rating System (CRS). Local government's can earn points through a number of different kinds of efforts including public information activities, mapping activities, regulatory activities, specific flood damage reduction activities and flood preparedness activities. These points are then converted into flood insurance savings for citizens of the community. For example, a community that adopts a floodplain ordinance that exceeds minimum standards may qualify its citizens for a downward adjustment in flood insurance premiums to account for the reduced risk of property damage under stronger ordinances. Currently none of the 5 Bay cities participate in the CRS program. Although the county participants, only those citizens in unincorporated areas (not on the Bay) are eligible for the 15 percent premium reduction the County has earned them.

Local Climate Action Plans

While policies to address climate change can be incorporated into many existing plans described in this section, many jurisdictions have elected to prepare plans specifically dedicated to this purpose. Historically, Climate Action Plans (CAPs) have focused on reducing emissions to mitigate the worst effects of climate change before they arise. Increasingly, local jurisdictions are also developing adaptation policies to respond to climate impacts like sea level rise and coastal flooding.

Four jurisdictions in the Adaptation Strategy planning area are addressing projected sea level rise through their CAPs. The City of Chula Vista recently incorporated adaptation strategies into its climate action planning efforts and included a policy to evaluate the recommendations

that will be developed in the San Diego Bay Adaptation Strategy. The City of San Diego also is currently updating its CAP to include adaptation policies. The Port is currently developing its first Climate Action Plan for both climate mitigation and adaptation. The City of National City is developing a climate action plan in conjunction with comprehensive updates of its general plan and land use code to be completed in 2011.

State Climate Adaptation Strategy

The State of California has recognized that climate change poses serious risks across the State. In November 2008, the Governor signed Executive Order S-13-08, which called on state agencies to develop California's first strategy to identify and prepare for these expected climate impacts. The 2009 California Climate Adaptation Strategy offers a comprehensive set of recommendations to inform and guide decision-makers in addressing climate impacts.

The Oceans and Coastal Resources chapter recommends a set of strategies for adapting to projected sea level rise. It recommends that state agencies assist local and regional agencies by providing regularly updated information on impacts and vulnerabilities, guidance on decision-making, and other tools and resources. Most significantly for local governments, it recommends that Local Coastal Program updates begin accounting for sea level rise considerations in 2011, and encourages local jurisdictions to take a "risk-averse" approach by limiting development in areas that could be affected.

2.2 Physical Landscape

This section details the existing physical landscape of the planning area, including both the built environment and the natural environment.

2.2.1 The Built Environment

Features of the built environment that are documented in this section include existing land use and building stock, major plans for changes in land use, critical utilities, emergency response facilities, and regionally-significant transportation facilities.

Existing Land Use and Building Stock

The planning area contains a broad spectrum of land uses and building types. The area is largely built-out and development usually takes the form of small infill projects or redevelopment of underutilized parcels. This section describes the general character and existing land uses in each of the Adaptation Strategy subareas. The narratives in this section are drawn from adopted community plans and general plans related to the Adaptation Strategy subareas. Figure 2.3 illustrates existing land uses.

San Diego – Peninsula

The Peninsula is a highly urbanized community comprised of a number of relatively distinct residential neighborhoods and the former Naval Training Center renamed Liberty Station. Also

within the Peninsula subarea is Shelter Island, with recreational and commercial uses, and part of the commercial area Point Loma Village.

San Diego – Midway

The Midway subarea is situated north of the Centre City area between Old Town and Point Loma. The area is comprised of two basic elements: the central Midway area and the narrow, linear-shaped Pacific Highway Corridor. Central Midway is characterized by wide streets, flat topography, and a varied mixture of flat-roofed large and small commercial buildings. The Pacific Highway Corridor, between Interstate 5 and San Diego International Airport, is defined by large scale buildings in the southern portion and a group of smaller scale, low lying industrial buildings in the northern portion.

Maps of the historic Pueblo lands around the original Old Town location show the San Diego River emptying from Mission Valley into the San Diego Bay over land which now comprises the Midway area; this was the case during a 50-year period beginning in the 1820s. In the later 19th century, dikes were constructed that diverted the course of the river back in Mission Bay, and later into the channel of what is now known as the mouth of the San Diego River.

Airport / Harbor Island

The Airport/Harbor Island subarea includes San Diego International Airport and commercial, recreational, hospitality, and marina uses on land-filled Harbor Island. Land in the airport vicinity is densely developed and has high land valuations due to the Airport's proximity of less than two miles from downtown San Diego.

San Diego – Centre City

Centre City, the downtown area of San Diego, is ideally positioned as the center of regional economic, residential, and cultural activity. Centre City's overall physical structure reflects its history and evolution. Key components include a land-filled waterfront dominated by large-scale maritime-related uses, which over time have given way to other large non-residential uses, such as the convention center and hotels; a core adjacent to the North Embarcadero, dominated by governmental use and office towers; and a fine-grained system of streets that extends throughout downtown inward of Harbor Drive. Finer areas of residential, small office, and light industrial uses surround the Core, stretching between the Adaptation Strategy planning area boundary and the waterfront.

San Diego – Barrio Logan

Barrio Logan includes a residential community that is made up of small lots with one and two houses per lot. A commercial area extends along Logan and National Avenues, and is presently made up of small stores, family grocery stores, and restaurants. The majority of the area is zoned to allow industrial, residential and commercial uses. Due to this mixed-use character, industrial activity is parceled throughout the community in a very inefficient pattern and conflicts exist with homes that were built prior to the industrialization.

Among the most notable of Barrio Logan's characteristics is the industrial complex situated along the waterfront of San Diego Harbor. This complex of activities and structures represents many diverse privately and publicly-owned enterprises that make this small area the most labor

intensive in the San Diego region. The major industries in this community alone provide for approximately 50 percent of all the exported goods and services in the San Diego area. The areas east and north of Harbor Drive include industrial activities such as warehousing, distribution, storage, vehicle salvage and metal recyclers. Most firms in this area have located and expanded here in a scattered, parcel-by-parcel manner as land became available.

National City

The portion of National City in the planning area is built-out and is bordered by existing development, protected habitat, and San Diego Bay. The Navy controls approximately two-thirds of National City's bay-front shoreline, through which public access is prohibited. The remainder of the bay-front shoreline is under the jurisdiction of the Port, and is developed predominantly with industrial uses. However, the Port has developed a launching ramp and an adjacent public recreation area at Pepper Park that accommodates public access to the shoreline – both pedestrian and boating.

The area west of Interstate 5 that *is* under National City's jurisdiction is almost entirely light and medium industrial uses, such as warehousing and light manufacturing. South of the industrial area is Paradise Marsh, which is part of the National Wildlife Refuge. The marsh experiences limited tidal action due to filling by the Port District and a man-made alteration of the natural creek bed.

Just east of Interstate 5, in the southern end of the planning area, is another light industrial area, bisected by the Sweetwater River flood control channel. Large-lot commercial and light industrial uses continue north next to the interstate, along with the City of National City Civic Center and main Police Station. In the northern end of the planning area, small lots support a mix of light industrial and residential uses.

Further east, National City becomes a more residential community with a mix of single-family and multi-family dwellings. These residential uses are served by a commercial strips and big-box commercial entities on Highland Ave.

Figure 2.3.1 Existing Land Use - North

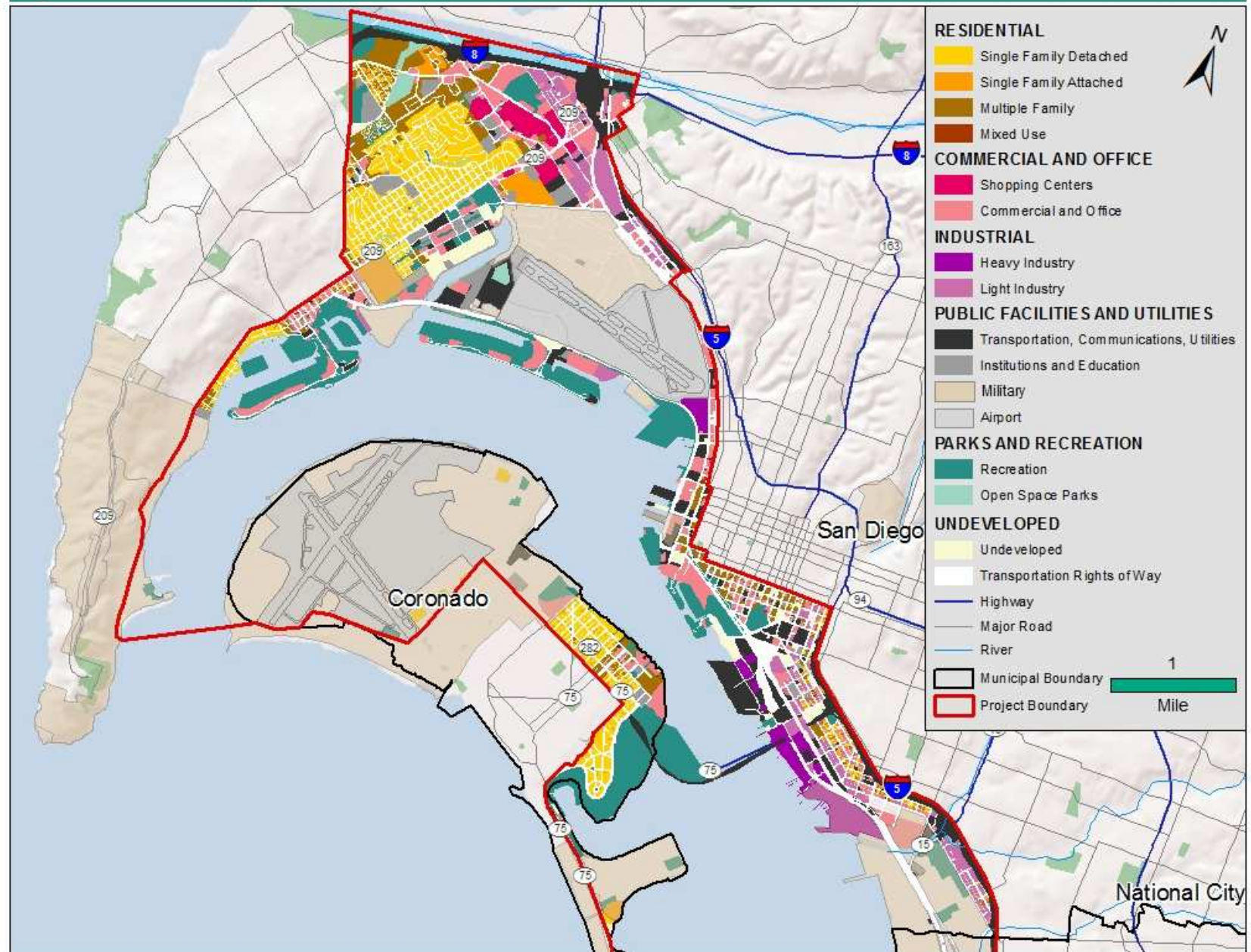
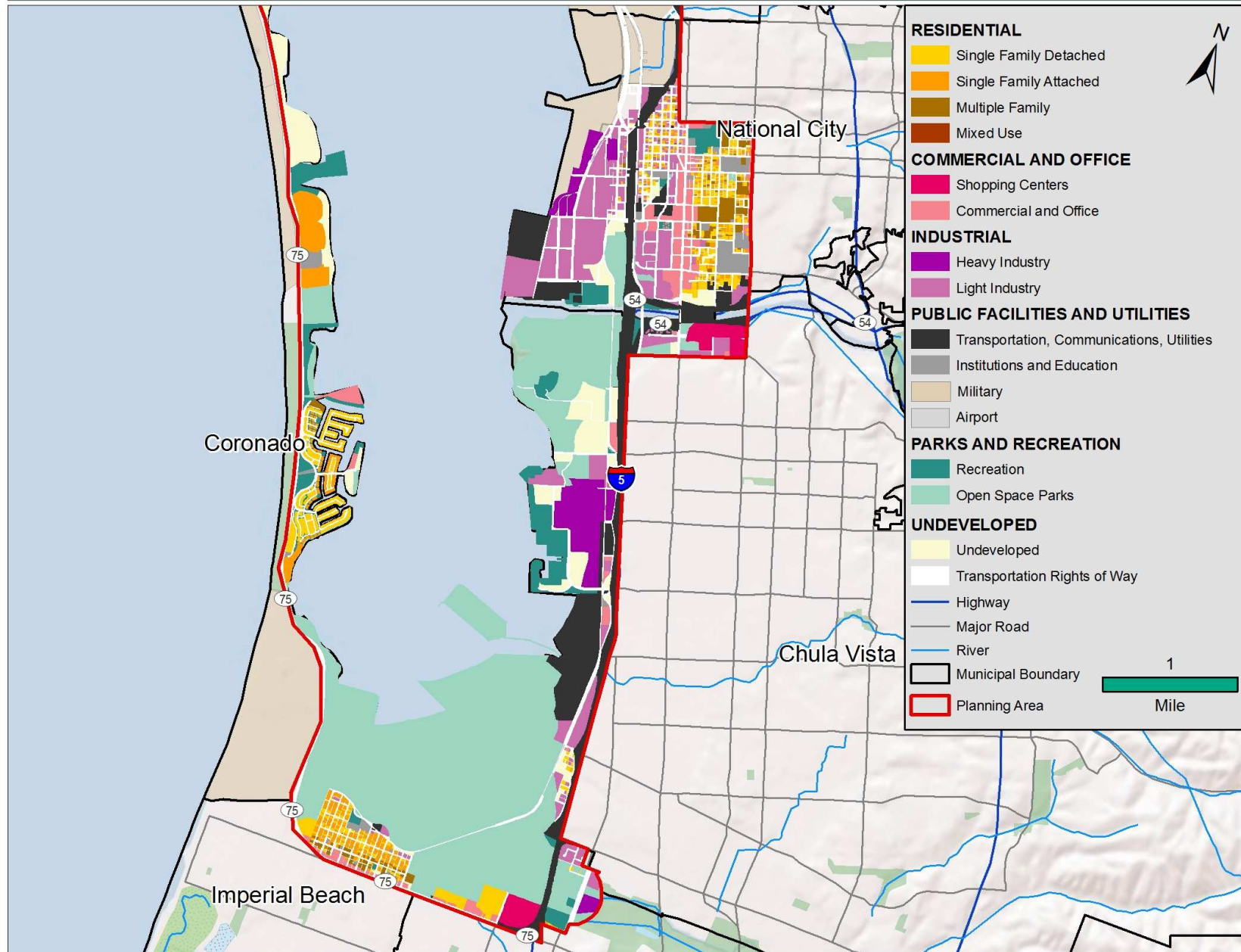


Figure 2.3.2 Existing Land Use - South



Chula Vista

The Chula Vista subarea is bounded on the east by Interstate 5 (also the Coastal Zone boundary), with the exception a few commercial parcels east of Interstate 5 and south of the Sweetwater River flood control channel. The subarea is often referred to as the Chula Vista Bayfront and is the subject of the recently adopted Bayfront Master Plan.

Currently the Bayfront is home to a mix of land uses, including conservation, recreation, commercial, industrial, and utilities. The northern portion of the subarea is an assemblage of wetlands often referred to collectively as Sweetwater Marsh. Most of this area is managed by the US Fish and Wildlife Service as part of the National Wildlife Refuge, and the City of Chula Vista owns the Chula Vista Nature Center in the central part of the marsh area.

The central Bayfront is mostly under Port jurisdiction. Near the shoreline, this area includes several public parks, two recreational marinas (with approximately 900 boat slips), a yacht club and boat launching ramp, a public fishing pier, a boat repair yard, a recreational vehicle (RV) park, and two restaurants. East of these facilities is the Goodrich Aerostructures Group manufacturing plant and other industrial uses.

The southern portion of the Bayfront consists of vacant, former industrial land under Port jurisdiction, the South Bay Power Plant, and an electricity substation.

San Diego – Nestor

The Nestor subarea is comprised of the salt ponds and portions of the Nestor Creek and Otay Valley floodplains west of Interstate 5. The Western Salt Company's salt production operation in this area provides community and regional economic, open space, wildlife habitat and historic value. The 1930's era wooden salt processing building is a local landmark signifying over eight decades of salt extraction from seawater in south San Diego Bay. Due to its unique natural resources, this area is included in the San Diego Bay National Wildlife Refuge. The Otay Valley Regional Park project links San Diego Bay to the Otay Lakes to the east, while providing recreational and educational opportunities for community and regional visitors. The subarea also includes a few parcels north of Palm Avenue in the Nestor community, occupied by a shopping center, residential development and a motel.

Imperial Beach

The Imperial Beach subarea consists of all of Imperial Beach between Highway 75 and the Bay. The subarea is almost entirely built-out. On the southern end of the subarea are strip commercial uses on Palm Avenue. The large majority of the subarea north of Palm Avenue is residential, with predominantly multi-family dwellings in the south transitioning to predominantly single-family dwellings in the north. At the western edge of the planning area is the Bernardo Shores RV park with 124 slips for large vehicles.

Coronado - Silver Strand

The Silver Strand is a low, narrow, sandy isthmus that is part of the City of Coronado. Silver Strand is 7 miles long and connects Imperial Beach to the south with Coronado to the north. Silver Strand, Coronado, and Point Loma Peninsula each contribute to sheltering San Diego Bay from coastal impacts. A large portion of Silver Strand is the Silver Strand State Beach, which in one area covers the entire width of Silver Strand, and offers camping, surfing,

swimming, fishing, and other recreational activities. The U.S. military owns land north and south of Silver Strand State Beach, for the Naval Amphibious Base Coronado to the north, and the Silver Strand Training Complex to the south. In addition to recreation and military uses, the Strand has a high-end residential subdivision, Coronado Cays, and the Loews Coronado Bay Resort.

Coronado – Island

This subarea consists of the area of Coronado adjacent to the Bay in the main “island” part of the city. Most of this subarea is single-family dwellings, some of which have historic value. Other land uses include retail and office on Orange Avenue and in the Old Ferry Landing shopping center, two hotels on the Bay shoreline, and Coronado’s only full-service hospital. Tidelands Park and a golf course are in the southern part of the subarea.

Planned Land Use

While some parts of the planning area are unlikely to see significant changes in their character into the future, others are evolving in the context of redevelopment and intensification of uses. This section describes some of the more prominent changes in land use that are either adopted or under development.

Airport

While travel through San Diego International Airport is expected to increase in the coming years, its growth is constrained by its location. The Airport Authority is evaluating options for accommodating increased demand in the region, but the alternatives currently under consideration do not envision either relocation of the airport’s main commercial passenger services or significant expansion of the Airport at its current site. However the Airport Authority is working with SANDAG to evaluate options for an intermodal transportation center adjacent to the Airport to connect air, rail, and bus travel to include in the Regional Transportation Plan.

San Diego – Centre City

With the majority of new residential development in the city currently occurring downtown, this area has been in the midst of a residential renaissance, though dampened by the current recession. The Centre City Community Plan envisions maintaining some aspects of downtown’s structure, while modifying others. Many of downtown’s neighborhoods, including Gaslamp and Marina, are now established and not expected to change significantly as downtown matures. Other areas, particularly in East Village, will undergo major transformations with increasing residential and commercial activity. The Core will acquire a greater mix of uses, and most importantly, will be complemented by seven Neighborhood Mixed-Use Centers distributed throughout downtown. The fine-grained street system will be maintained, and extended to the waterfront in places where reuse is envisioned. Larger parcels at the western waterfront will be broken up, creating a fine-grained mixed-use district and land uses that provide vitality and are a draw for residents and visitors.

Chula Vista

The Chula Vista Bayfront will be significantly redeveloped through a cooperative public/private planning effort by the Port, City of Chula Vista, and Pacifica Companies. The development will be one of the largest waterfront planned developments in the state and it is expected to enhance the city and regional economy. Prominent characteristics of the Chula Vista Bayfront Master Plan include the development of a resort, convention center, and other hotels, a signature park and other park and open space areas, a large ecological buffer, up to 1,500 residential units, mixed-use office/commercial recreation, retail, cultural uses, and reconfiguration of the existing Chula Vista Harbor. Several actions, including undergrounding of existing transmission lines, remediation of the former industrial sites, and demolition of the South Bay Power Plant and SDG&E substation are being separately addressed by the regulatory agencies responsible for their review and approval. Both the Coastal Commission and the State Lands Commission will have a role in approving the Bayfront Master Plan.

The Bayfront Master Plan, as approved, has planned for a projected 2050 scenario of 19 inches of sea level rise. Upland areas in the Bayfront Master Plan will also be adaptively managed to create appropriate transitional habitat to take into account potential climate change and sea level rise impacts.

Critical Facilities

The San Diego Multi-Jurisdictional Hazard Mitigation Plan defines a critical facility as “a facility in either the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the County, or fulfills important public safety, emergency response, and/or disaster recovery functions.”

This section covers public and private sector facilities that provide essential services to the general public of San Diego Bay area. Under the category of utilities it addresses potable water, wastewater and electricity generation. This section also addresses emergency response facilities including – military facilities, hospitals, fire stations and police stations. Major regional sites that contain contaminated substances are also included in this section. Finally, it includes all major regional transportation resources. It should be noted social services such as employment and shopping areas are addressed under the social section of this report.

Critical Utilities

The Adaptation Strategy planning area contains complex networks of utilities that are vital to maintaining essential services for millions of the region’s residents. Among the systems that could be impacted by sea level rise are potable water, wastewater, and electricity, which are discussed in this section. Figure 2.4 shows the major regional potable water, wastewater and electricity generation facilities in the Adaptation Strategy planning area.

Figure 2.4 Major Regional Facilities - Wastewater, Water, and Energy



Wastewater

The regional wastewater system serves all local jurisdictions around the Bay, including the Port. It is planned, constructed, and operated by the City of San Diego Metropolitan Wastewater District (MWD). In the Adaptation Strategy planning area there are no sewer treatment plants. MWD however operates other major facilities in the planning area, including Pump Stations #1 and #2, associated force mains conveying sewage to the Point Loma Wastewater Treatment Plant, a wet well overflow tank near Shoreline Park, and major interceptor sewers. In addition to the major regional facilities, each city owns and operates its own local sewer facilities that feed into the regional system. The Transbay Pump Station is a major facility operated by the City of Coronado.

Potable Water

Potable water in the San Diego Bay is provided through several different suppliers. The City of San Diego has its own water supply system. The Sweetwater Authority, a publicly owned agency, provides water to National City and the part of Chula Vista that is in the planning area. California American Water, an investor owned subsidiary of American Water provides drinking water to Coronado and Imperial Beach. None of the major treatment plants or storage facilities fall within the planning area. There are, however, many pressure reducing valves and mains that are within the planning area boundary

Electricity

Electricity infrastructure in the planning area consists of generation facilities, transmission and distribution, and substations. There are approximately five small electricity generation facilities that are not major sources of electricity for the SDG&E grid; the major South Bay Power Plant (SBPP) on the southern Chula Vista bay-front was taken out of operation in January 2011. In addition to generation facilities, there are over a dozen substations and a network of transmission and distribution lines owned and operated by San Diego Gas and Electric (SDG&E) in the planning area.

Critical Buildings

Although many facilities are necessary to maintain the social structure of a community, only a select few are needed for the important functions of public safety, emergency response, disaster recovery, and national security. These critical buildings include hospitals, fire stations, and police stations. There are twenty-one emergency response facilities in the Adaptation Strategy planning area, which is approximately ten percent of all the regional facilities. These facilities are shown in Figure 2.5.

Of the 25 regional hospitals, only one, the Sharp Coronado Hospital, falls within the Adaptation Strategy planning area. This hospital is located on the peninsula's southeastern edge near Tidelands Park, and is the community's only hospital. It has 204-beds and provides emergency services, surgical care, intensive care, as well as sub-acute and long-term care. There is also only one city operated police station – National City Police Station – that falls within the Adaptation Strategy planning area. Additionally, the Port manages two harbor police stations located on Shelter and Harbor Islands. Finally, there are eleven fire stations in the planning area.

Figure 2.5 Critical Buildings

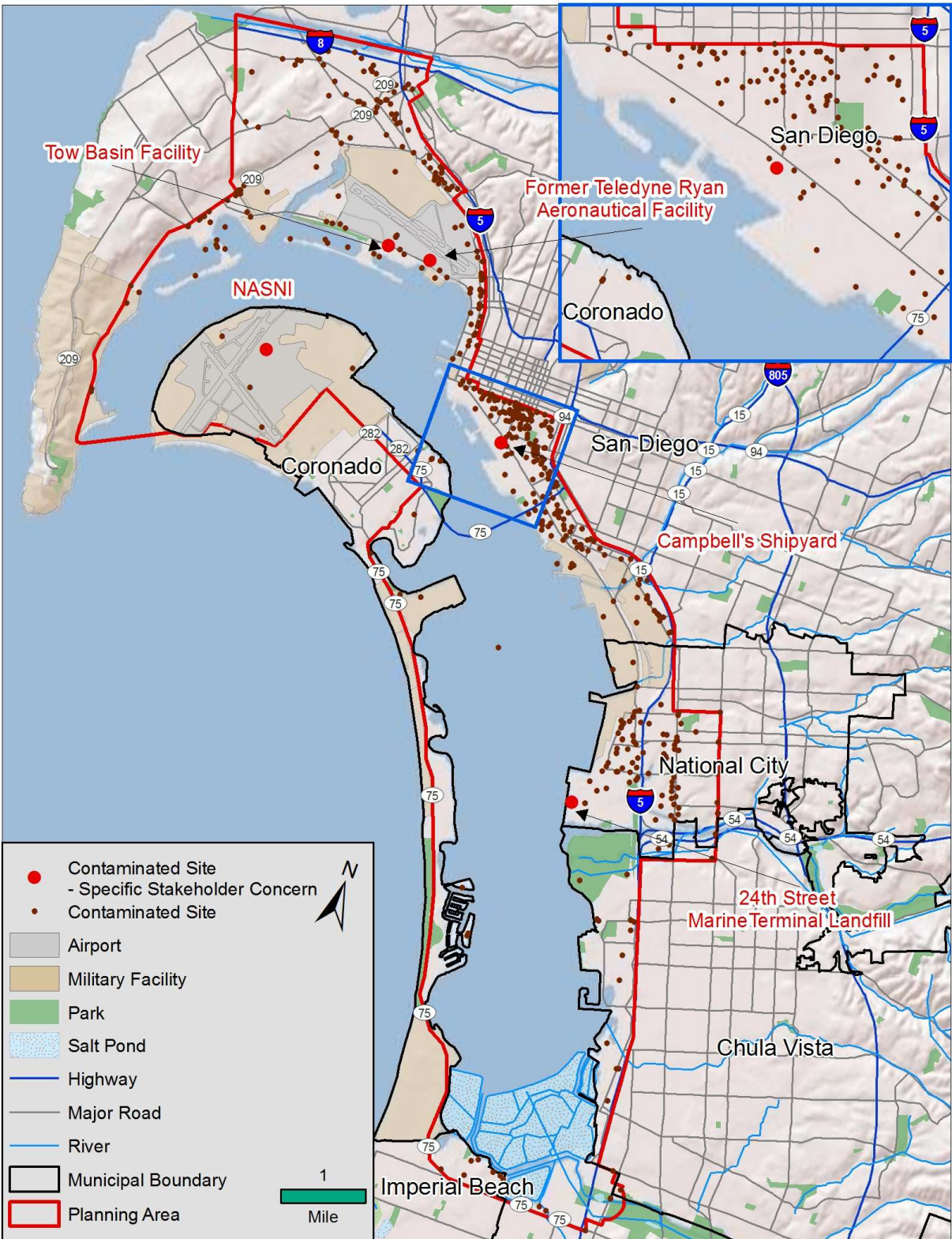


Critical Contaminated Sites

According to data from the California Department of Toxic Substance Control's (DTSC) database and California's Water Resources Control Board's database there are more than 400 sites that have undergone review or clean up for being contaminated in the planning area. These sites include operating hazardous waste sites, school clean up sites, voluntary clean up sites (where owners initiated the clean up process), leaking underground storage tanks (LUST) and others. Additionally, the area has some underwater confined disposal facilities. Amongst these sites local stakeholders have articulated concerns about the following:

- Tow Basin Facility covering 1.41 acres located on Harbor Island East Basin in San Diego. The site clean up is considered complete by DTSC as of December 3rd, 2009. The location's groundwater, sediments, soils, and soil vapors were contaminated with PCBs from paint on the building.
- The Naval Air Station North Island (NASNI) has a number of waste related facilities associated with it. There is an underwater confined disposal facilities referred to as the homeporting pier. Additionally, in the northwest portion there is an area called Installation Restoration (IR) Site 9 (commonly referred to as fiery marsh). This area has Volatile Organic Compounds (VOCs) that are said to be migrating into San Diego Bay through the groundwater. Finally there's the North Island Hazardous Waste Facility Complex that treats and stores hazardous waste at the center of North Island's military facility under a permit originally issued in 1998 and renewed in 2007.
- The 24th Street Marine Terminal Landfill (Formerly PACO terminals) located in National City near the intersection of Terminal Avenue and West 32nd Street is a clean up and containment site. It has wastes from shipping operations at the Marine Terminal and involves ongoing monitoring of the site.
- Campbell's Shipyard, located just south of the convention center, is another LUST case that was considered closed by the Regional Water Quality Control Board (RWQCB) on September 27th, 2006. Located in San Diego it contaminated groundwater with gasoline and required excavation and treatment.
- The former Teledyne Ryan Aeronautical (TRA) facility adjacent to the San Diego International Airport drains to Convair Lagoon. It has been subject to RWQCB cleanup and abatement orders six times since 1986. The contamination is of surface water from a variety of pollutants including PCB-1248, PCB-1260, diesel, gasoline and jet fuel.
- Convair Lagoon is a 5.7 acres underwater confined disposal site in the northern part of the Bay near the airport. There is 3 foot layer of sand that was constructed in 1998 to cap and encapsulate PCBs found in the Lagoon sediments in the mid 1980s. The cap is bounded by the shoreline and a rock berm on the seaward side
- Old San Diego dump site under Convention Center expansion.

Figure 2.6 Contaminated Sites



Critical Transportation Facilities

The San Diego Bay area is home to a large number of transportation options and associated facilities, as shown in Figure 2.6. With the exception of the airport and the marine based facilities, the San Diego Association of Governments (SANDAG) serves as the regional decision-making and strategic planning body for regional transportation facilities. Though noted in this existing conditions report in an effort to capture the current situation in the San Diego Bay area, all future plans for regional transportation facilities are documented in 2030 Regional Transportation Plan (RTP) adopted in November 2007. Further plans are underway in the 2050 plan that the agency is currently drafting.

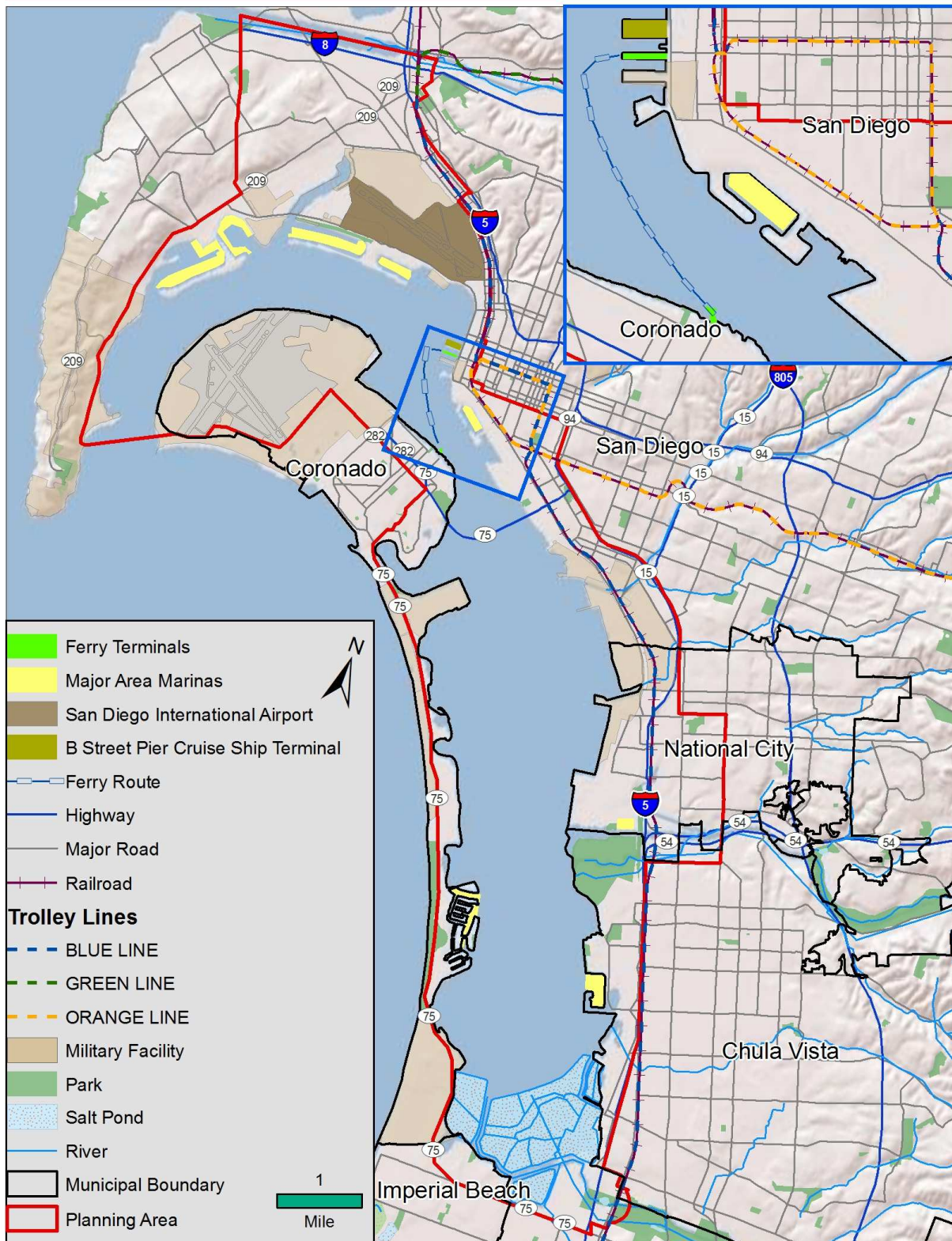
On-road vehicles remain the primary mode of transportation. In the Adaptation Strategy planning area, there are roughly 17 miles of freeway and around 85 miles of other major regional roads, with the most regionally significant roads being Interstate 5, Interstate 8, Highway 75/Silver Strand Blvd, Highway 54, and the Coronado Bridge and its approaches. Interstate 5 either coincides with or inside of the Adaptation Strategy planning area boundary for much of the area; however in the Centre City subarea it is just outside the boundary. Interstate 8, which has around 2.25 miles of freeway in the Adaptation Strategy planning area, lies just south of the planning area boundary. Highway 75 provides the southern and western boundary of the Adaptation Strategy planning area.

Although driving remains the primary means of transportation, there is infrastructure in the area for alternatives, including commuter rail, trolley (light rail), bike lanes and more. There are nearly 70 miles of railroad tracks in the Adaptation Strategy planning area. The most significant of rail facilities that fall within this area are the heavy rail lines that carry Amtrak, Coaster commuter rail, freight rail and the blue and orange trolley lines. The commuter rail service runs between Old Town Transit Center (near intersection of I-5 and I-8) and Santa Fe Depot (downtown, at Broadway and Kettner) and goes in and out of the Adaptation Strategy planning area in this section. Freight on this line continues south of Santa Fe Depot to the 10th Avenue Marine Terminal and National City Marine Terminal. Both the blue and orange trolley lines run through the Adaptation Strategy planning area. The blue line starts at the Old Town Transit Center and runs the length of the Bay (but is only inside the Adaptation Strategy planning area until National City).

Marine transportation plays a key role in moving goods and people into the region and around the Bay. For pleasure craft, the significant area marinas are at Harbor Island, Shelter Island, the Embarcadero, Coronado Yacht Club, and Chula Vista Bayfront. There are ferry terminals along the Embarcadero in San Diego and at Old Ferry Landing in Coronado. The Cruise Ship Terminal located along the Embarcadero is also a significant area passenger transportation facility. A variety of products are imported to the region and unloaded at the 10th Avenue and National City Marine Terminals.

Finally, San Diego International Airport is a critical regional transportation facility. It is the third largest airport in California with over 9 million boarding passengers (enplanements) annually, accommodating commercial passenger services, air cargo, and general aviation.

Figure 2.7 Critical Transportation Facilities



2.2.2 The Natural Environment

This section addresses San Diego's natural resources from both habitat and topographic standpoints. The environmentally sensitive areas information is based on several sources including information from the regional multi-species conservation program (MSCP), the comprehensive conservation plan of the U.S. Fish and Wildlife Service (USFWS), and the integrated natural resource management plan of the Port and the Navy. The topographic and flooding section is based upon the county's hazard mitigation plan as well as FEMA Flood Insurance Rate Maps (FIRMs) Geographic Information System (GIS) layers.

Environmentally Sensitive Areas

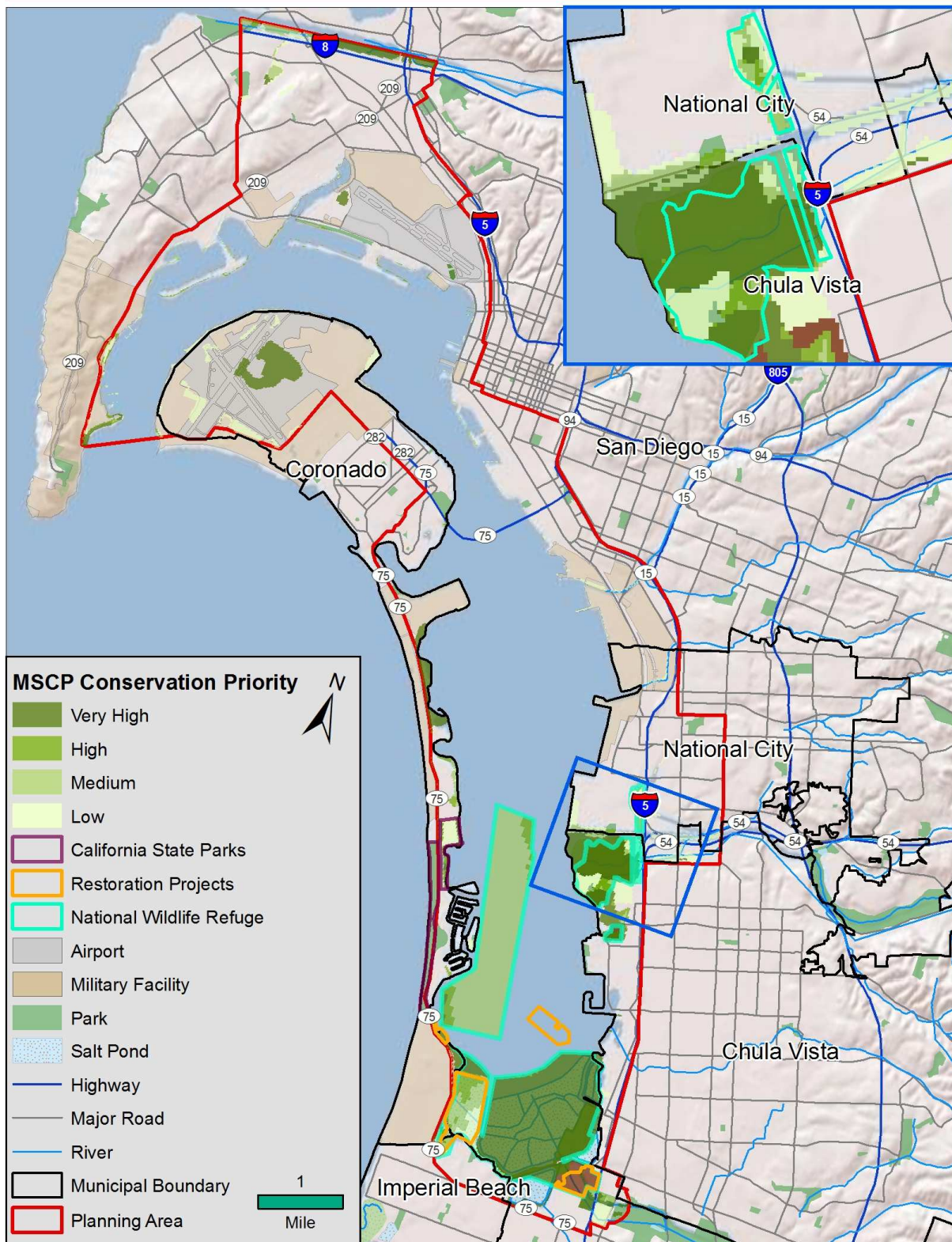
The San Diego region is a highly biodiverse region and is home to many threatened or endangered species. In 1998, local jurisdictions created a regional Multiple Species Conservation Program (MSCP) to help protect the area's rich environmental systems. The program aims to achieve this goal through preservation and adaptive management of large blocks of interconnected habitats and smaller areas that support rare vegetation communities. As part of the MSCP planning process, core habitat areas were identified and ranked for habitat value using a geographic information system (GIS) habitat evaluation model and site specific assessments.

Approximately seven percent of the Adaptation Strategy planning area was given a habitat ranking value, with approximately 23 percent of these ranked as very high value. Three of these core habitat areas—the Sweetwater Marsh area, the South San Diego Bay/Salt Ponds area, and the vernal pools of Otay Mesa/Nestor—fall within the Adaptation Strategy planning area. These conservation priority areas are illustrated in Figure 2.7. In addition to the Sweetwater Marsh, the 1998 USFWS acquisition boundary that created the South Bay wildlife refuge is an area of sensitive habitat in the San Diego Bay. Other critical habitat areas around the bay include the Famosa Slough, Paradise March and Creek, J Street marsh and tidal flats, the research marsh in the southwest corner of the Bay, and the Navy's mitigation wildlife island.

The protected Sweetwater Marsh area in Chula Vista and Paradise Marsh and Creek in National City are located along the eastern edge of San Diego Bay and support tidally influenced salt marsh habitat and disturbed upland habitat. According to the US Fish and Wildlife Service's Conservation Plan for the area, these habitats "support a variety of migratory shorebirds and wintering waterfowl, as well as the endangered light-footed clapper rail, a year-round resident of the marsh. Although the upland areas have experienced extensive human disturbance, portions of these uplands provide important habitat for ground nesting birds. Other upland areas provide opportunities to restore native upland and wetland habitats that historically occurred here. The Sweetwater Marsh Unit provides habitat for two federally endangered bird species, the California least tern and lightfooted clapper rail, one threatened species of bird, the western snowy plover, and one endangered plant species, salt marsh bird's beak."

"The Salt Pond complex, which consists of diked open water cells with differing levels of salinity, provides roosting habitat for a variety of migratory birds during high tide, supplemental foraging habitat for various shorebirds, and primary foraging habitat for other species such as phalaropes and eared grebes. The salt pond levees also provide nesting habitat for a variety of ground nesting birds, including the endangered California least tern, the threatened western

Figure 2.8 Critical Habitat Areas



snowy plover, and an array of other tern species, some of which only nest in a few locations in the United States. The American Bird Conservancy has designated the South San Diego Bay Unit as a Globally Important Bird Area due to the presence of globally significant numbers of nesting gull-billed terns and continentally significant numbers of surf scoters, Caspian terns, and western snowy plovers.”²

Beyond the U.S. Fish and Wildlife Service habitat areas, there are a number of specific habitat types and California least tern nesting areas that should be highlighted. Eelgrass beds in San Diego Bay play a crucial role for area wildlife and economic life. These beds, which make up nearly 20% of all eelgrass habitat in California, support a variety of ecologically important species and play a key role in supporting area fisheries. Specifically, the endangered Eastern Pacific green sea turtle forages in the eelgrass beds in San Diego Bay. The endangered California least tern relies on several key nesting areas within the planning area including the ovals at the airport, several Navy-managed sites, the D street fill, and the Navy’s mitigation wildlife island. Finally, it should be noted that intertidal mudflats and shallow, hypersaline subtidal waters around the South San Diego Bay shoreline also support a great diversity of fish indigenous to the area and several dozen species of shorebirds.

Environmental Restoration

The U.S. Fish and Wildlife Service, in collaboration with a variety of project partners, is coordinating several habitat restoration efforts around San Diego Bay. These efforts, shown in Figure 2.7, encompass over 300 acres of tidal flats, salt marsh, subtidal and native upland habitat. The 4 projects – Emory Cove, Western Salt Ponds, Otay Delta and the Chula Vista Wildlife Reserve – will transform these areas such that they will be able to provide essential habitat to birds, fish and other, marine life, and native plants. Major construction, which began in September of 2010, is projected to continue through March of 2011, while planting will continue for up to five years. In addition to restoring lost critical habitat, the project will include a Bayside Birding and Walking Trail that will be open to the public.

Topography and Floodplains

San Diego County’s topography, which greatly affects its current and future flooding potential, is said to consist of two main regions – the semi-arid coastal plain and the rolling highlands. Figure 2.8 illustrates the topography and floodplains in the Adaptation Strategy planning area. The area falls entirely within the coastal plain, reaching a maximum elevation of approximately 206 feet. With the exception of the northwestern edge of the planning area, the region within San Diego referred to as the Peninsula, there is a relatively gradual gain in elevation as one heads away from the Bay. The Peninsula area, however, has a steep rise from the coastal area, culminating in rolling hills.

Flooding in San Diego Bay can manifest as riverine flooding, coastal flooding from heightened storm surges and storm wave runup, or coastal backwater flooding from submerged or obstructed storm drain outfalls. Riverine and coastal flooding events are currently mapped by

² US Fish and Wildlife Service. (2006). *San Diego Bay National Wildlife Refuge Comprehensive Conservation Plan*.

FEMA based upon the area's historical flooding record. From 1950 – 2005 there were ten Proclaimed States of Emergency associated with flooding in San Diego. In 1983 a series of El Nino-driven coastal storms damaged 3,900 homes and business and resulted in the complete destruction of thirty-three homes. Additionally, the storms caused over 116 million dollars in beach and coastal damages. Also in the 1980s, there was riverine flooding that caused the San Diego River to flood in the Mission Valley area. This flooding peaked at 27,000 cubic feet per second (cfs) and caused \$120 million in damage.³

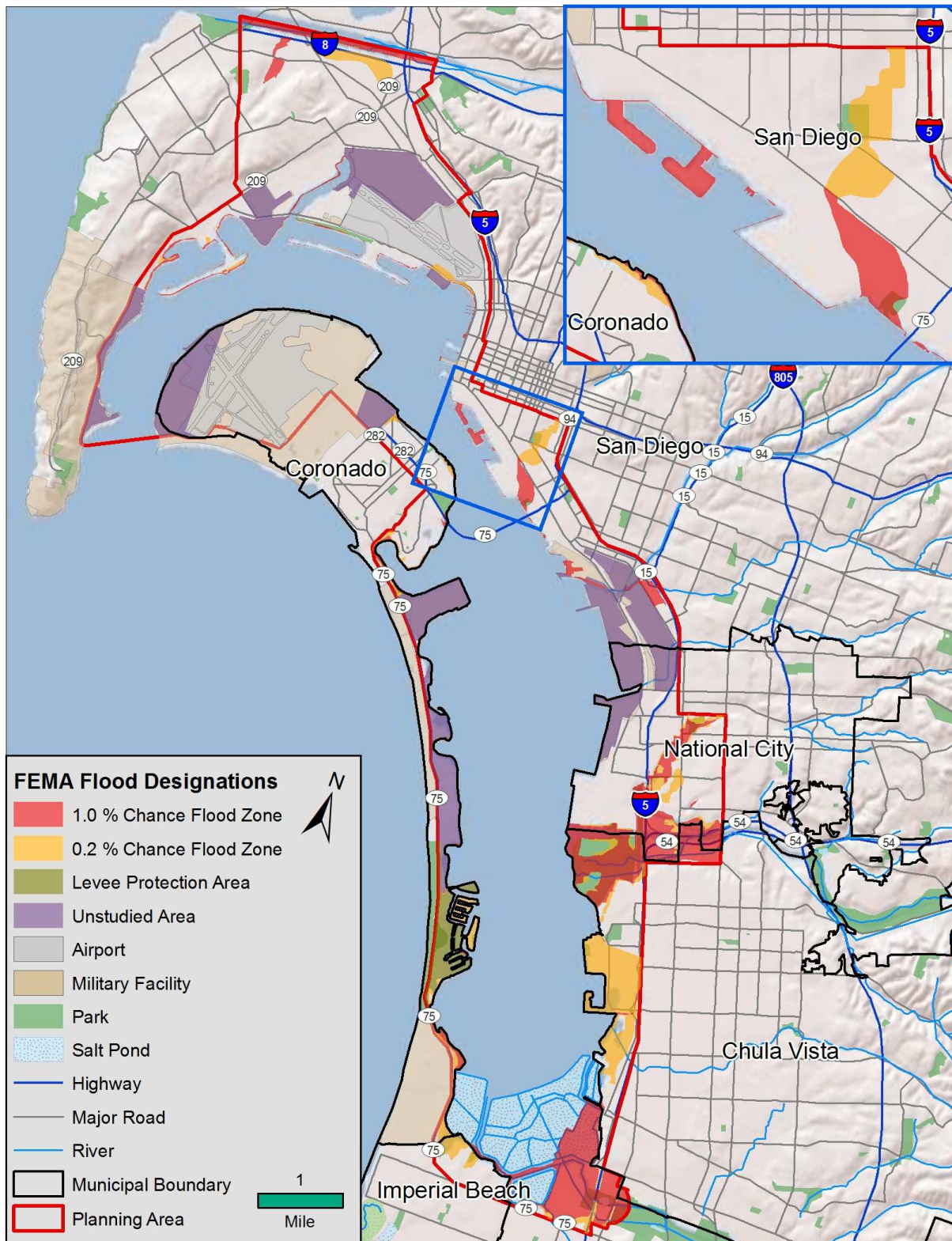
The San Diego County's hazard mitigation plan relies upon FEMA's Flood Insurance Rate Map (FIRMs) to determine hazard risks from flooding. These risks are based upon the statistical notion of an area that has on average a 1% change of flooding in any given year. More commonly referred to as the 100-year flood zone, areas with a 1% flood chance are considered to be high risk areas. Within these high risk zones areas there are sub classifications based upon the type of flooding expected. There are several areas that have additional risks associated with moving water. Specifically in the coastal areas there are V zones, which are considered to have an increased risk due to storm associated velocity wave action. In contrast to these high risk areas there are also areas with lower risks. There are mapped areas for the 0.2 % change storm (the 500 year storm), which are considered low risk by the County's hazard mitigation plan. X zones are areas of minimal flood hazard based upon traditional flood analysis; however since local drainage systems are not considered, there could be localized flood risks in these areas. Finally, some communities in the San Diego Bay area have unstudied areas that are called Zone D. Despite being unstudied, the National Flood Insurance Program does offer flood insurance to these areas, meaning they are still likely to be vulnerable to flooding.

Flooding in San Diego is mapped primarily along coastal areas and in several major river areas that are prone to flash floods. Approximately 6.3 percent of San Diego has been mapped as a flood hazard zone and in the planning area the percentage of area specifically mapped as at risk is roughly 8.5%. This at risk area can be divided into higher risk – 1% chance flood zones – and lower risk – 0.2% change flood zones. As shown in Figure 2.8, the majority of the 1% chance flooding is in the Sweetwater and Otay River areas, while the majority of the lower risk flooding is in the Chula Vista Bay district. In addition to these mapped risk areas, there are two other important designations to note in the planning area. The first is an area FEMA has mapped as not at risk due to protection by a levee. This area is located toward the southern end of the Silver Strand area. The other important regional designation is zone D areas. There are eleven unstudied areas in the planning area all of which correspond to military facilities.

Finally, it should be noted that the planning area does not include zones (i.e. those designated as V or AO by FEMA) that include additional moving water hazards, such as waves. This is likely due to the protection provided by the Silver Strand, Coronado and Peninsula areas.

³ San Diego County (2010). *Multi-jurisdictional Hazard Mitigation Plan*.

Figure 2.9 Current FEMA Flood Designations



2.3 Social Landscape

The landscape of San Diego Bay can also be analyzed through a social lens focusing on the communities that live around the Bay and the benefits they gain from an active and safe Bay coastline. The following section highlights social features that are particularly critical and that could be exposed to sea level rise in the coming years.

2.3.1 *Vulnerable Populations*

There are several communities in the Adaptation Strategy planning area that are home to a high concentration of “vulnerable populations,” including low-income residents, the homeless, elderly, youth, ethnic minorities, and recent immigrants. These groups may have more difficulty in accessing services and participating in planning processes that could help them increase resilience. Historically these groups have been subjected to inequitable policies that negatively impacted their quality of life. It is critical to identify vulnerable populations in order to ensure that future actions to increase resilience are selected and implemented in an equitable and just way.

Though a hub of commercial activity and higher-end residential units currently exist, the Centre City area also includes many single-resident-occupancy residences that are inhabited by low-income, housing-insecure populations. There are also several homeless shelters and social service organizations in the area, and a large homeless population is based here to access these services.

The Barrio Logan area to the south is a predominantly Latino neighborhood populated mostly by long-time, working-class residents, but with a significant population of recent immigrants and low-income people as well. National City and Imperial Beach have a similar demographic profile of vulnerable populations. Barrio Logan and National City have significant concentrations of young people as well. Elderly populations are more pronounced in Coronado and in the Midway area, home to several nursing home complexes.

2.3.2 *Economic Hubs*

The Bay coastline is a key economic asset for the region. Centre City is the central business district of the San Diego region, and is the center of the region’s finance, insurance, real estate, law, and utility sectors and home to many corporate offices. It has an active real estate development market and a significant tourism sector based on several prime tourist attractions and a major convention center, which supports a large hospitality sector. San Diego’s cruise ship terminal in Centre City is also a major revenue generator - bringing thousands of visitors to the area. North of Centre City, San Diego International Airport is a key facility in maintaining the region’s economic competitiveness.

The entire planning area contains a large number of hotels, with the largest concentrations in Centre City, Harbor Island, Shelter Island, and Coronado. These facilities support the Bay’s attraction as tourist destination providing everything from affordable to luxury spaces to stay.

Additionally, these hotels provide jobs to many area residents thus helping to sustain the region's economic success.

While industry is not as prevalent on the Bay as in years past, there remains a working waterfront in the Barrio Logan and National City areas. Several ship repair facilities and a major shipbuilding facility operate south of the Coronado Bridge. There are also large marine freight terminals at 10th Avenue in San Diego and in National City.

Smaller commercial centers are distributed around the Bay, including those around Central Midway, Pacific Highway, Liberty Station, and Point Loma Village in San Diego; National City Blvd in National City; and Old Ferry Landing and Orange Avenue in Coronado. As Chula Vista develops its bay-front to include hospitality, office, and neighborhood commercial uses, it is likely to emerge as a significant economic center as well.

2.3.3 Public Access

Public access to the shoreline is fundamental to the livability of the region and is central to both the Coastal Act and the "common use" intentions of the public trust doctrine. Major public access points around the Bay include:

- Shelter Island Drive Park (San Diego)
- Harbor Island Drive Park (San Diego)
- Spanish Landing Park (San Diego)
- Embarcadero/Harbor Drive (San Diego)
- Seaport Village (San Diego)
- Embarcadero Marina Park (San Diego)
- Crosby Street Park (San Diego)
- Pepper Park (National City)
- Sweetwater Marsh National Wildlife Refuge (Chula Vista)
- Chula Vista Bayfront Park
- Bayside Park (Chula Vista)
- 13th Street Bayshore Bikeway (Imperial Beach)
- Silver Strand State Beach / Crown Cove Aquatic Center (Coronado)
- Tidelands Park (Coronado)
- Bayview Park (Coronado)
- Centennial Park (Coronado)
- Old Ferry Landing (Coronado)

In addition to these locations, the Bayshore Bikeway provides access to and views of San Diego Bay at many locations on its route.

2.3.4 Arts and Culture

Major arts and cultural facilities in the planning area include:

- San Diego Convention Center

- Petco Park
- San Diego Museum of Contemporary Art
- Balboa Theater
- San Diego Civic Theater
- Chicano Park
- Humphreys by the Bay
- San Diego Sports Arena

Many of these cultural facilities also have historic value, and are high priorities for preservation for that reason.

2.3.5 Historic Resources

Places are often intimately connected to and defined by their past and San Diego Bay is no exception. With a rich ancient and modern history there are many specific locations and districts in the planning area that are significant. There is evidence that human life in the area can be dated as far back as 20,000 years ago with the Kumeyaay, who hunted and gathered along the coastal areas.

European history in the area began in 1542 with the arrival of the first Spanish settlers who planted the flag of Spain. In 1850, the City of San Diego was officially established in California. This shift led to prosperity for the city, which saw a growth in population and economic development. Between 1886 and 1888 the historic Gaslamp Quarter was built and the first public transit system, the San Diego Street Car Co., was founded and constructed around the Bay. Another major turning point in San Diego's history was the establishment of the area as a "Navy Town," which began in 1912 when the U.S. Navy built its first bases in the area. This history has led to a number of special area buildings and districts in the San Diego Bay, which are listed below.⁴

Specific properties with historic value:

- Coronado boat house (1887)
- Fort Guijarros (1797)
- Archaeological whaling industry building
- Historic Tiki Structures
- Historic maritime museum
- Building were spirit of St. Louis was built
- TL Ryan historic building
- San Diego old police head quarters

Designated historic districts or areas:

- Coronado Historic Homes District
- Naval Training Center District
- Asian-Pacific Thematic District
- Gaslamp District
- Ocean Beach Cottage Emerging District
- John Lautner Historic Harbor

⁴ <http://www.californiacruisin.com/history-of-san-diego-bay.php>

3. CLIMATE CHANGE AND SEA LEVEL RISE SCENARIOS

This section takes a brief look at the conditions caused by our changing climate and the impacts these changing conditions may have on the San Diego region. It also looks more closely at the predicted ranges of sea level rise and at the anticipated results of these impacts.

3.1 Global Climate Change

Over the past century there have been numerous documented changes in climate globally. To-date, the world has seen increases in annual average temperatures, altered precipitation patterns, and sea level rise. Globally, temperatures have increased 1.3°F over the past century resulting in less snow accumulation in the winter and an earlier arrival of spring. Sea level has been rising globally at a rate of 0.8 inches per decade or 0.67 feet over the century, another documented impact of the earth's changing climate. These global climate change trends – increasing temperatures, altered precipitation patterns, and rising sea level – are expected to continue into the future. But the rate of many of these changes is expected to increase.⁵

When analyzing future climate conditions, it is necessary to rely on models to determine global climate projections. These models are based on greenhouse gas emissions scenarios created by

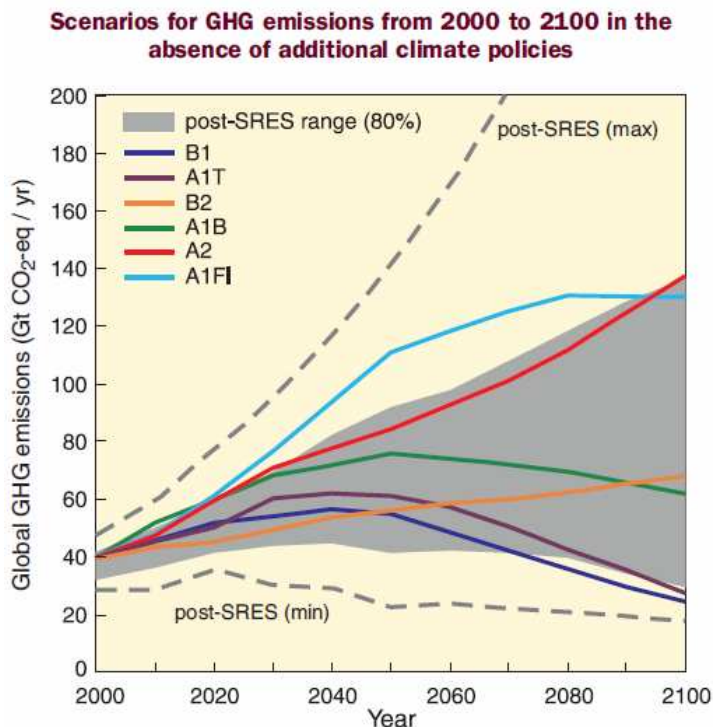


Figure 3.1: Emissions Scenarios used by the Intergovernmental Panel on Climate Change. Each line represents a different greenhouse gas emission paradigm.

the Intergovernmental Panel on Climate Change (IPCC). The scenarios factor in variables including population growth, energy use, and societal choices. Most analyses of changing climatic conditions and associated impacts include a high and a low emissions scenario to create a range of possible future climate scenarios. This range can be seen in figure 3.1, which shows six different greenhouse gas emissions scenarios from the 2000 IPCC Special Report on Emissions Scenarios. One high emissions scenario shown is the A2 scenario (red), which is based upon a world with high population growth, slow economic development motivated by maximizing growth, and high fossil fuel use. The B1 scenario (dark blue) envisions economic prosperity that is managed in a more sustainable way, with similar population projections to A1.

⁵ Intergovernmental Panel on Climate Change (IPCC) (2007) *Climate Change 2007: Synthesis Report for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*.

It is important to recognize that there is a certain amount of climate change that will be experienced in the coming decades regardless of global greenhouse gas emissions reductions. This is due to a lag in the climate system. Specifically, the warming that is projected for the next fifty years is similar regardless of high or low emissions scenarios. However, after this near term period there is a considerable difference between the two emissions scenarios, as shown in Figure 3.2. In the next sections we look at the climate changes that can be expected in the San Diego region.⁶

3.2 Regional Climate Change

To date, the vast majority of climate science and future scenario building has been done via global climate models. In order to make these coarse resolution projections relevant at the regional scale statistical or dynamical downscaling techniques must be used. For this report one state report – California’s Climate Action Teams March 2009 – and one local report – The San Diego Foundation Regional Focus 2050 Study – were used. Both reports relied upon a number of methodologies including specific global circulations models (GCMs) for changing climactic conditions, and a combination of analytical models and literature reviews for certain impacts of these changing conditions.⁷

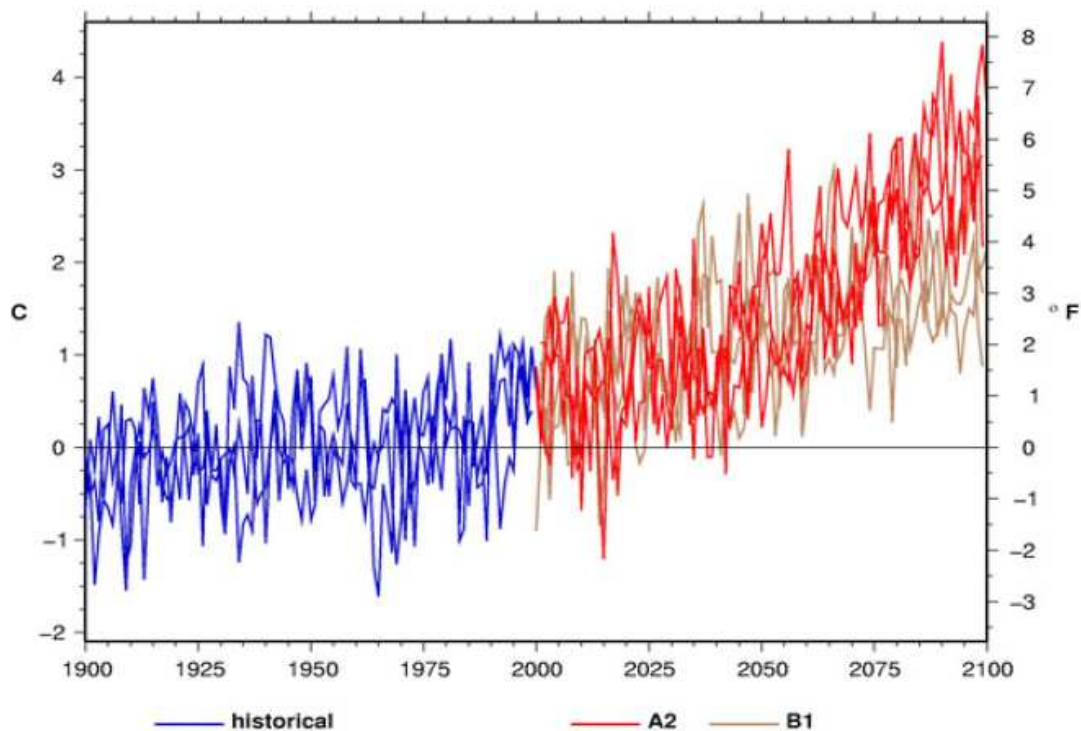


Figure 3.2: Annual mean temperature change for San Diego over the past 100 years and projected under two greenhouse gas emissions scenarios. The high scenario (red line) is based upon the A2 emissions scenario and the low scenario (brown line) is based upon the B1 emissions scenarios. (Messner p. 12)

⁶ State of California (2009). *Climate Action Team Biennial Report*.

⁷ The San Diego Foundation (2008). *Regional Focus 2050 Study*.

In terms of temperature changes both reports indicate that all models predict ongoing warming for the San Diego area. According the San Diego Foundation report this warming will be between 1.5°F and 4.5°F (0.8°C to 2.5°C Figure 3.2) by mid century. Both reports also found that there is greater warming in the summer months than in the winter months. Focus 2050 found that there is a Pacific Ocean effect and that warming within 50 km of the coast will be more moderate while warming inland will be as much as 2°F (1.1°C) higher than in the coastal areas.⁸

Precipitation in the state of California is considered to follow a Mediterranean pattern with most of the annual rainfall occurring during the cooler part of the year – November through March. Generally the models indicated that this pattern will continue in the coming century. However, according to the San Diego report, the models are inconsistent when it comes to precipitation increases. Three models show an increase in annual average precipitation, while three show a decrease. The models also vary on their storminess predictions with none showing significant changes. Both reports did find however that the State and the regions tend to have high year to year precipitation differences that are expected to continue in the coming century.⁹

As shown in Figure 3.3, sea level rise has been documented in the San Diego Bay since 1906 with a rise of 0.68 feet over the last century.¹⁰ Scientists however believe that the rate of sea level rise will increase in the coming century, with global sea level rising up to 4.6 ft.¹¹ The State, noting that California’s sea level rise trend is similar to the Global trend, is projecting that by 2050 the rise could be between 11 and 18 inches (30 to 45 cm) and by 2100 the rise could be between 23 to 55 inches (60 to 140 cm) above sea levels in 2000. The San Diego Foundation Study states that three simulations indicated a rise of 12 to 18 inches by 2050. The next section looks at the potential impacts from these changing climate conditions.

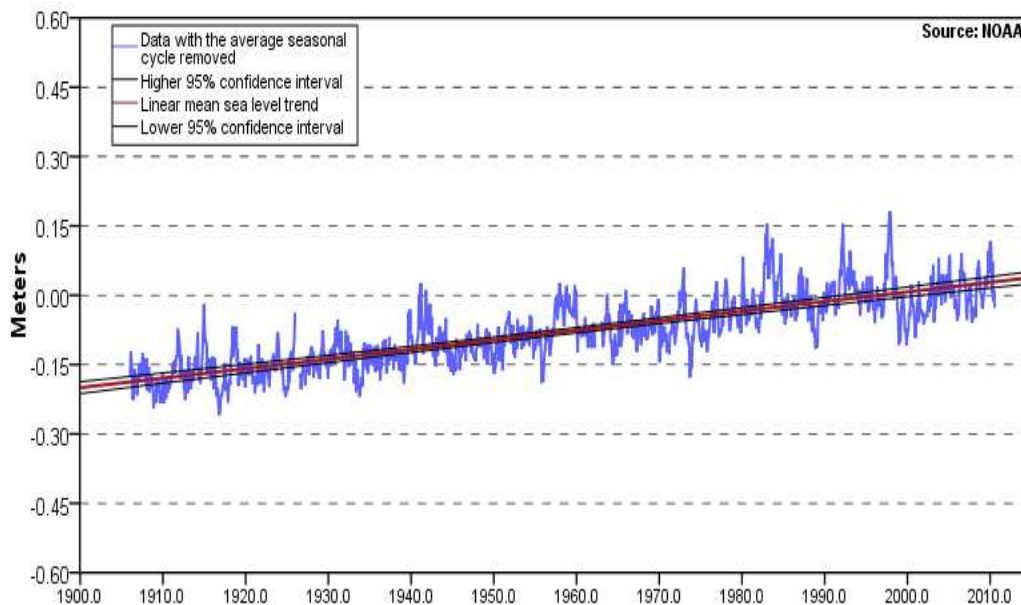


Figure 3.3: Historic sea level rise trend for San Diego Bay

⁸ The San Diego Foundation (2008). *Regional Focus 2050 Study*.

⁹ State of California (2009). *Climate Action Team Biennial Report*

3.3 The Impacts of Climate Change on the San Diego Bay Area

The changing climate conditions – increases in temperature, changing precipitation patterns and sea level rise – discussed in the previous section will have specific impacts on a variety of systems in the San Diego Bay area over the coming century. These could include an increased risk of drought, increased likelihood of wildfires, more extreme heat events and associated air pollution, increased flooding and increased exposure to vector-borne diseases.

Sea level rise in particular is projected to have a number of impacts on many systems in the region. First, in the San Diego Bay area it is expected to increase the frequency of coastal extreme high sea events. Another impact of sea level rise is that the 1 percent chance storm (the 100 year storm) could reach farther landward and could affect a greater overall area. Both of these sea level rise impacts will result in increased flooding to the San Diego Bay's built and natural environment. In addition to changes in flooding patterns, sea level rise will also cause heightened sea events to persist for more hours and will likely cause increased erosion specifically on non-hardened shorelines. The Silver Strand area, consisting of extensive wave-exposed, non-hardened shore line is particularly vulnerable to these changes and there is some chance that extensive erosion and flooding to this area could result in breach of the area that in the long term could become permanent. Were such a breach to occur, Coronado Island would become a separate island and the bay's hydrodynamics would shift considerably. Additionally, heightened seas are often associated with increased wave action, an affect that will not be distributed equally throughout the bay. The northern bay areas of Peninsula and North Coronado Island are more likely to see some increased wave action, while the Southern Bay, which does not see major wave action today is likely to remain similarly calm in the future if Silver Strand is not breached.¹²

Sea level rise is also predicted impact natural systems in several key ways. It is expected to cause the landward migration of intertidal natural environments, specifically wetlands, dunes and rocky beaches. However, if there is nowhere for these features to migrate, then sea level rise would likely result in the complete loss or fracturing of these systems.¹³ The loss of these intertidal habitats would be highly destructive to the many species that rely heavily on their existence. Changing sea levels will also result in changing hydrodynamics and therefore in shifting underwater habitats. These shifts will affect fish and other underwater species. Many of these changes could be further exacerbated by increases in water temperature and shifts in chemical composition.

3.4 Flood Mapping of the San Diego Bay Area

This section presents results from a model of sea level rise inundation performed by a team led by Dr. Rick Gersberg at San Diego State University. The model utilizes a basic “bathtub” inundation method, whereby a future sea level is added to a specific tidal event and the resultant flooding is determined based on topographic information. It should be noted that this

¹⁰ NOAA (2008). *Sea Level Trends*.

¹¹ Vermeer, M. & Rahmstorf, S. (2009). *Global sea level linked to global temperature*.

¹² The San Diego Foundation (2008). *Regional Focus 2050 Study*.

¹³ The San Diego Foundation (2008). *Regional Focus 2050 Study*.

methodology does not take into account a number of factors that could increase or decrease the extent of the flooding. Specifically it does not account for wave runup, alterations to the landform from erosion, or nearshore bathymetry that influences tide levels. Also unaccounted for is localized “backwater” flooding that could result from storm outfalls being submerged and inundated. Finally, the method also does not account for existing shoreline protection infrastructure such as sea walls or revetments. Despite these drawbacks, this method does provide meaningful information on low-lying areas that are could be exposed to flooding under various sea level rise scenarios.

Figures 3.4 and 3.5 show different flooding events under two sea level rise scenarios. A half-meter scenario corresponds with what is likely in the 2050 timeframe, as described in Section 3.1 above. A 1.5 meter scenario corresponds with the high-end of possible sea level rise by 2100.¹⁴ For each scenario, the figure shows flooding under a potential 10-year tidal event (a combination of storm surge, El Nino-related rise, and tidal variation occurring on average once every ten years) and a potential 100-year tidal event with the same parameters.

The flooding illustrated under the half-meter scenario is significantly less. The majority of this flooding is expected to occur in areas directly adjacent to existing water bodies. Specifically, the high tide line in the salt pond area, the Sweetwater River area and the Navy boat channel east of the airport could move farther landward. The other area of note under the lower sea level rise scenario is the Naval Amphibious Base in Coronado’s Silver Strand area, which could be split into two sections under the lower sea level rise scenario.

The 1.5-meter sea level rise scenario results in significantly more potential future flooding. The following areas are shown as affected by inundation from this scenario (from the south counter-clockwise):

- the Salt Ponds
- parts of the Otay River floodplain
- Sweetwater Marsh area
- Sweetwater River floodplain extending as far as Kimball Park in National City
- various Port shoreline marine facilities
- San Diego Convention Center
- Embarcadero Marina Park
- parts of San Diego International Airport and Harbor Drive
- parts of Liberty Station
- much of San Diego’s Midway area
- parts of City of Coronado including Tidelands Park and the golf course
- much of the Silver Strand
- mostly undeveloped floodplain in Imperial Beach

¹⁴ In the Vulnerability Analysis to be prepared as the next deliverable, a more thorough description of the confidence levels, or likelihood, of these scenarios will be provided.

Figure 3.4 Sea Level Rise Flooding - 0.5 Meters Scenarios

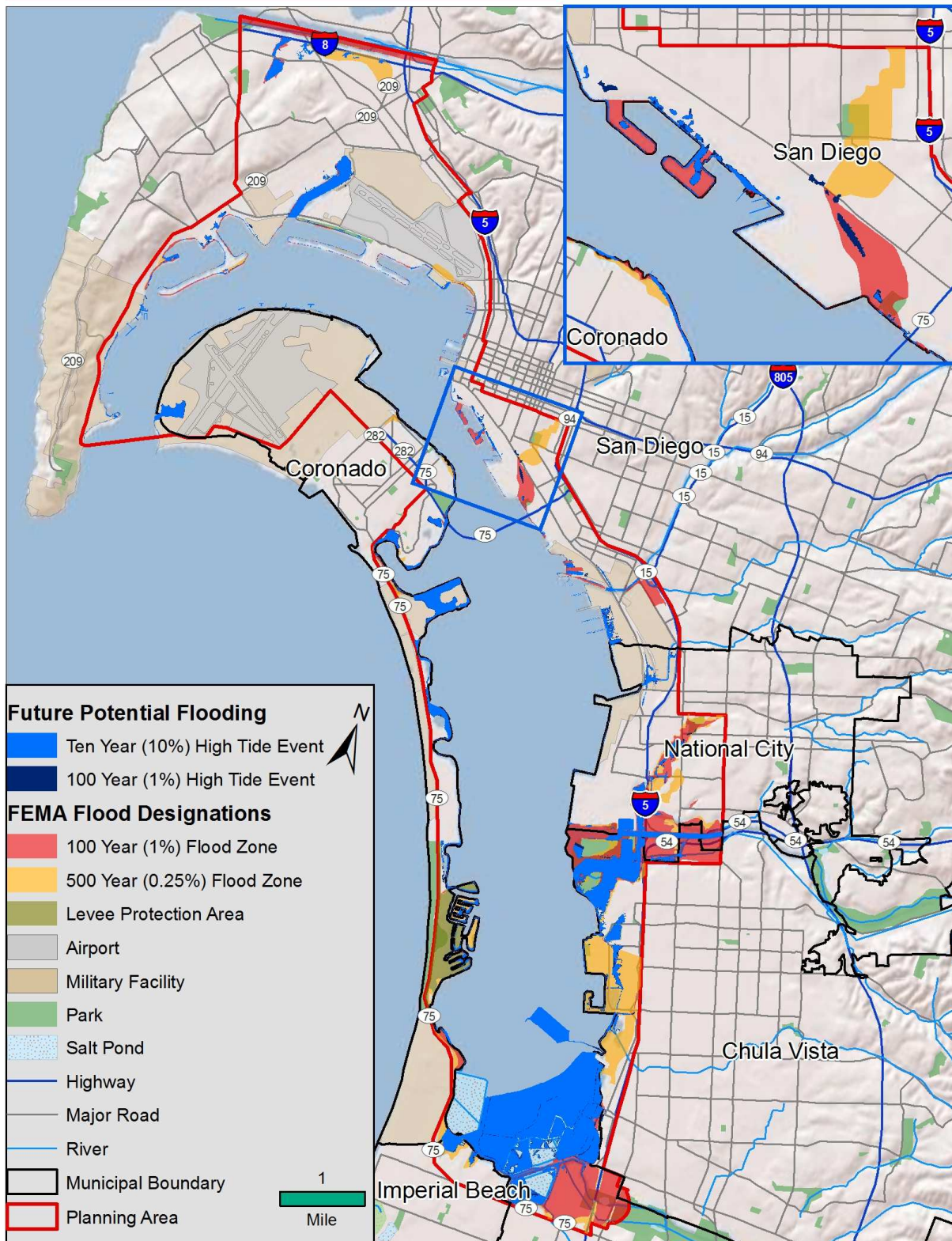
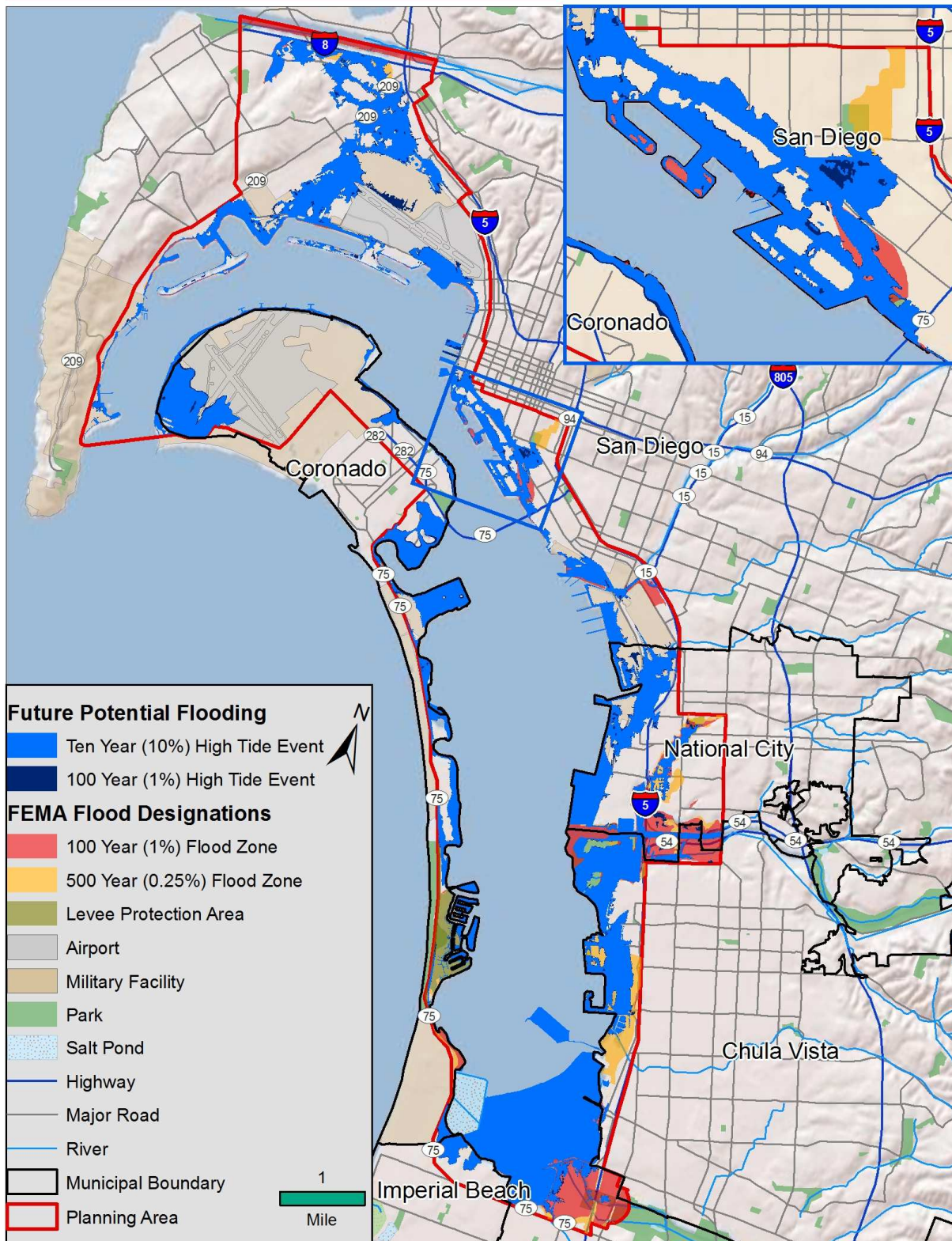


Figure 3.5 Sea Level Rise Flooding - 1.5 Meter Scenarios



4. NEXT STEPS

This report is the first of multiple steps in development of the *Sea Level Rise Adaptation Strategy for San Diego Bay*. The report will be revised based on input received at the Stakeholders Working Group workshop on November 1, 2010. Stakeholders can also provide written comments up to November 5, at which time all comments will be addressed in a Final version of the document for Steering Committee review. The Final document will be distributed to stakeholders before the end of the year, and changes made based on stakeholder comments will be presented at the Working Group's subsequent workshop, currently targeted for late-February.

Between November and February, ICLEI will use the Report to inform the development of the next deliverable: the vulnerability assessment. In association with this assessment, ICLEI will also assemble technical advisors from a variety of disciplines to provide topic-specific expertise.

Between stakeholder workshops, Steering Committee Co-chairs and the project manager are available at any time to field ideas, address concerns, or answer questions.

Brendan Reed, Co-chair
Environmental Resource Manager
City of Chula Vista
Dept. of Conservation & Environmental Services
(619) 409-5889
breed@ci.chula-vista.ca.us

Michelle White, Co-chair
Senior Environmental Specialist
San Diego Unified Port District
(619) 686-7297
mwhite@portofsandiego.org

Brian Holland, Project Manager
Senior Regional Officer
ICLEI – Local Governments for Sustainability
(619) 476-5364
brian.holland@iclei.org

5. ENDNOTES

- Gersberg, R. (2010) *1.5 meter sea level rise scenarios*. Data transmitted to ICLEI on September 23, 2010.
- Intergovernmental Panel on Climate Change (IPCC) (2007). *Climate Change 2007: Synthesis Report for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Available Online: www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf
- Messner, S., Miranda, S., Green, K., Phillips, C., Dudley J., Cayan D., and Young, E. (2008). The San Diego Foundation Regional Focus 2050 Study (Focus 2050). Prepared for the 2008 Climate Change Impacts Assessment, Second Biennial Science Report to the California Climate Action Team. Available Online: http://www.cleantechsandiego.org/reports/Focus2050_Technical%20Assesment.pdf
- NOAA (2008). Sea Level Trend, retrieved from http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=9410170.
- San Diego County (2010). *Multi-jurisdictional Hazard Mitigation Plan*.
- State of California (2009). *Climate Action Team Biennial Report*, available at www.energy.ca.gov/2009publications/CAT-1000-2009-003/CAT-1000-2009-003-D.PDF
- US Fish and Wildlife Service (2006). *San Diego Bay National Wildlife Refuge Comprehensive Conservation Plan*.
- Vermeer, M. & Rahmstorf, S. (2009). Global sea level linked to global temperature. Proceedings of the National Academy of Sciences of the United States of America. Available Online: <http://www.pnas.org/content/early/2009/12/04/0907765106.full.pdf+html>